ABSTRACTS OF NORTH AMERICAN GEOLOGY

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UNITED STATES DEPARTMENT OF THE INTERIOR
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WALTER J. HICKEL, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

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ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports of memorandums) or of other papers presented orally at meetings.

The Abstracts is an additional reference tool but does not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology are published each year. The Bibliography includes citations and subject index for a calendar year.

The numbers assigned to the abstracts in this publication are for reference in using the index; they are not order numbers. Publications cited here in abstract form are available in most geological libraries or through interlibrary loan.

Abstracts of North American Geology and the Bibliography are prepared by use of computer techniques. Each abstract, along with its indexing, is placed on magnetic tape and entered into a permanent data bank. The material prepared each month is published in the form of the present issue. The abstracts are arranged alphabetically according to senior author. A subject index follows the abstracts and is designed for rapid reference to any subject desired. Bibliographies can subsequently be retrieved according to the terms used in the index.

A list of journals commonly cited in Abstracts of North American Geology may be obtained by writing to the U.S. Geological Survey, Washington, D. C. 20242. Serial publications cited for the first time are as follows:

Nevada Div. Water Resources, Water Resources Bull.—State of Nevada Department of Conservation and Natural Resources, Division of Water Resources, Water Resources Bulletin. Carson City, Nev.

The abstracts in this issue were prepared by Sidney R. Ash, Georgianna D. Conant, Howard R. Cramer, Harald Drewes, George H. Dixon, S. E. Frezon, Elizabeth Hambleton, John W. Hosterman, Lyman C. Huff, Virginia M. Jussen, B. H. Kent, Elisabeth S. Loud, V. E. McKelvey, Mildred C. Mead, E. A. Merewether, Philip B. Mudgett, Virginia S. Neuschel, Henry W. Roehler, E. G. Sable, Gregg Vane, and Dorothy B. Vitaliano.

ABSTRACTS

08023 **Abdul-Latif, Numan A. R.** Synthesis of clay minerals [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2657B, 1969.

00442 **Abu-moustafa, Adel A.; Skehan, James W.** Petrography and geochemistry of the Nashoba Formation of the Wachusett-Marlborough Tunnel, Massachusetts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 1, p. 9, 1970.

Acaroglu, E. R. *See* Graf, W. H. 07946

07859 **Adams, J. A. S.** Total and spectrometric gamma-ray surveys from helicopters and vehicles, *in* Nuclear techniques and mineral resources — Symposium, Buenos Aires, 1968, Proc.: Vienna, Austria, Internat. Atomic Energy Agency, p. 147-161, illus., tables, discussion, 1969.

A single-channel gamma-ray spectrometer, built and tested in surveys from the air and vehicles, uses a 5 × 5 in. sodium iodide (thallium activated) scintillation crystal and can detect Th, U, and K anomalies in the upper 10 to 25 cm of soil or rock. The 750 km of modern beach in Texas were completely surveyed by helicopter in five flying days. Anomalies containing as little as 6 ppm Th and 3 ppm U were readily detected at ground speeds of 105 km per hr and elevations of 17 ± 1 m. A complete coverage of the surface can be obtained in the Texas uranium districts at costs well under 175 dollars per km^2. The relative contributions of Th or U to a particular total gamma-ray anomaly have been successfully measured by gamma-spectrometry from the air at the above altitudes and ground speeds. The instrumentation has application for direct exploration for K, Th, and U and for bedded phosphates of over 10 ppm U and placer deposits of twice background Th or U. — *from* Author's abstract

Adams, John A. S. *See* Baldwin, Otha D. 00484

00432 **Adrian, Donald Dean.** Infiltration induced soil instabilities: Ground Water, v. 8, no. 1, p. 29-36, illus., 1970.

Experiments confirmed a mechanism by which capillary forces hinder water infiltration into soils. Infiltration into unsaturated soil overlying an impermeable barrier displaces interstitial air which, unable to escape downward, may bubble upward through large pores; if pores are small and capillary forces large, the air is compressed, reducing the infiltration rate, and an almost stable wetting front may result. With sufficient air pressure build-up, sudden localized horizontal rupture of the soil at the wetting front may lift it along with the infiltrating water, forming a cavity; this breaks the flow passage and percolation ceases there. In observed soil columns when displaced air could escape, the wetting front moved three inches in less than one minute; this took two weeks when air was not free to escape and the soil ruptured. Grain size and packing limit the capillary pressure build-up and bubbling pressure. — *from* Author's abstract

07915 **Aegerter, S.; Oeschger, H.; Renaud, A.; Schumacher, E.** Studies based on the tritium content of the samples, *in* Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, p. 76-88, illus., tables, 1969.

A study of névé cores from various locations on the Greenland Icecap showed that tritium concentration generally decreases with depth. Fluctuations in the tritium profiles were found to correlate with solar activity and galactic cosmic radiation. Tritium production rate in the Arctic was estimated at 0.9 tritium atoms/cm²sec, compared with a global rate of 0.45 tritium atoms/cm²sec. Of these, 0.25 tritium atoms/cm²sec are said to be received from the Sun. — EH

00219 **Aki, Keiiti; DeFazio, Thomas; Reasenberg, Paul; Nur, Amos.** Active experiment with earthquake fault for an estimation of the in situ stress [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 65, 1970.

00220 **Alcock, Edward D.** Dynamic amplification spectra of thin layers of alluvium [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 65, 1970.

00221 **Algermissen, S. T.; Stepp, J. C.; Rinehart, W. A.; Arnold, E. P.** The estimation of earthquake losses to wood frame structures in California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 66, 1970.

00222 **Algermissen, S. T.; Brown, Robert D.** The Managua, Nicaragua earthquake of January 4, 1968 [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 66, 1970.

Algermissen, S. T. *See* Stepp, J. C. 07836

08162 **Allaart, Jan H.** The chronology and petrography of the Gardar dykes between Igaliko Fjord and Redekammen, South Greenland: Grönlands Geol. Undersögelse Rap. 25, 26 p., illus., table, geol. map, 1969.

The intrusion of the Precambrian dykes of the area between Igaliko Fjord and Redekammen [east of the Ilímaussaq intrusion] probably spans the greater part of the Gardar period. These dykes consist of various generations of lamprophyres, olivine dolerites, feldspar xenocryst dykes, and just saturated and undersaturated microsyenites. Often the alkaline dykes are composite. A tentative chronological interpretation, mainly based on intersections, is presented. — Author's abstract

08170 **Allen, W. H., Jr.; Vreeken, W. J.; Miller, G. A.** Postglacial environments of the Des Moines Lobe, *in* The many faces of geology — Tri-State [Geol.] Field Conf., 33d, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, p. 56-67, illus., tables, 1969.

The Des Moines drift lobe (Cary age), the last Wisconsin glacial deposit recorded in Iowa, covers 22 percent of the state, from Des Moines north to the Minnesota state line. Ages of 13,820 to 14,700 yr are recorded for the base of the Cary till. The Algona moraine, the last major recessional moraine, is dated at approximately 13,000 yr B. P. The entire lobe was formed in 1,000 yr. Two major erosion cycles modified the former drift surface; five bogs on a south-north line in the east-central part of the lobe were studied in detail. The stratigraphic sequence of double mineral and double organic strata found in Jewell bog was found to occur essentially unchanged in the other bogs. — EH

Allison, E. C. *See* Winterer, Edward L. 07996

Allison, Edwin C. *See* Hawkins, James W., Jr. 00280

00223 **Allison, Richard C.** Turritellids of the genus *Woodsalia* Olsson from the Americas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 66-67, 1970.

08096 **Allman, David W.; Williams, Roy E.; Stephenson, Gordon R.** Design and operation of an inexpensive sensitive piezometer with short timelag: Ground Water, v. 7, no. 6, p. 14-16, illus., 1969.

The need for a piezometer possessing longevity, precision, sensitivity, and short timelag, as well as ease of installation, minimum maintainance, low capital investment, and provision of a continuous record, was encountered during a flow-system

study beneath an irrigated field [near Boise, Idaho]. A piezometer subsequently designed combines the sensitivity of a Keck electrical water-level sensing device with the continuous record provided by a Stevens Type F, graphic recorder. Replacement of the standard sensing probe with one designed for small diameter pipes provides instrumentation with a short timelag. The absence of a diaphragm and strain gauges enhances longevity. The device is inexpensive, simple and easily installed. Samples of well water for chemical analysis may also be obtained from the piezometers. — *from* Authors' abstract

Alptekin, Omer. *See* Sanford, Allan. 00354

Al-Rawi, Y. *See* Christensen, M. N. 00244

07827 **Anderson, A.; Loh, Y. T.** Low temperature Raman spectrum of rhombic sulfur: Canadian Jour. Chemistry, v. 47, no. 6, p. 879-884, illus., tables, 1969.

Raman spectra of polycrystalline samples of rhombic sulfur have been recorded at 100 and 300°K, with excitation by the 5145 A line of an argon ion laser. Spectra of sulfur solutions in carbon disulfide and bromoform were also obtained to aid in assignments. Experimental confirmation is presented of the frequencies of two intramolecular fundamental vibrations, suggested from normal coordinate analysis (one at very low frequency, the other inactive in both Raman and infrared for the free molecule). The spectra are analyzed in terms of the static and correlation crystal field perturbations, and for all except the weakest bands, substantial agreement is obtained. It is concluded that the effects of the two types of interaction are comparable in magnitude, and that a correct analysis must take account of the full symmetry of the unit cell. — Authors' abstract

Anderson, D. L. *See* Hofmann, R. B. 00286

00413 **Anderson, Don L.** Velocity-density relations: Jour. Geophys. Research, v. 75, no. 8, p. 1623-1624, table, 1970.

Birch (1961) found an empirical linear relationship between density and compressional velocity in rocks. Anderson (1967) subsequently showed, on theoretical grounds, that density should be proportional to some power of the bulk sound velocity C, and fitted two equations to the same data: one completely arbitrary and one being the analog of Birch's relationship, with C replacing Vp. As Wang (1968) has recently used one of these equations in discussing the composition of the mantle, it is appropriate to present now the parameters found by fitting both equations to the data sets used in Anderson (1967). The parameters of least-squares solutions of three forms of the velocity-density relation are tabulated for various sets of data. — DBV

Anglin, F. M. *See* Basham, P. W. 00417

Araki, Takaharu. *See* Ito, Tei-ichi. 08081

00446 **Armington, A. F.; O'Connor, J. J.** Recrystallization by shifting the equilibrium of chemical complexes — The growth of cinnabar: Jour. Crystal Growth, v. 6, no. 3, p. 278-280, illus., 1970.

In this communication a method of growing cinnabar by the decomposition of a chemical complex is presented. It is believed that this technique is a general method applicable to a large number of systems. — Authors' abstract

00406 **Armstrong, Augustus K.** Mississippian dolomites from the Lisburne Group, Killik River, Mount Bupto region, Brooks Range, Alaska: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 251-264, illus., 1970.

These allocthonous Osagian and Meramecian shelf carbonate rocks are extensively dolomitized and silicified. Carbonates were deposited as open-marine echinoderm-bryozoan wackestone, packstone, and grainstone with interbedded carbonate mudstone in shallow, restricted, marine to supratidal environment. Sequence of

diagenetic events in the dolomite is silicification of limestone to form chert nodules, followed by dolomitization probably from hypersaline brines in a supratidal environment. Dolomite porosity is thought to have been caused by dolomitization. — EGS

00480 **Armstrong, Richard Lee.** Geochronology of Tertiary igneous rocks, eastern Basin and Range Province, western Utah, eastern Nevada, and vicinity, U.S.A.: Geochim. et Cosmochim. Acta, v. 34, no. 2, p. 203-232, illus., tables, 1970.

More than 100 new K-Ar dates for volcanic and intrusive rocks from the eastern Basin and Range Province provide numerous tests of the dating technique. With single samples, Tertiary volcanic units can be dated with a precision of ±4 percent, and with multiple samples, up to ±1-2 percent. All available dates show a consistent regional pattern — scattered igneous intrusions in late Eocene-early Oligocene time in the Wasatch region, in northern Nevada, and probably at Gold Hill, Utah; intense igneous activity in and near east-central Nevada during Oligocene time; activity shifting towards the eastern and southern margins of the Great Basin during Miocene and Pliocene time and gradually decreasing in intensity to only sporadic eruption of mafic lavas. — DBV

00481 **Armstrong, Richard Lee.** K-Ar dating using neutron activation for Ar analysis — Comparison with isotope dilation Ar analyses: Geochim. et Cosmochim. Acta, v. 34, no. 2, p. 233-236, illus., tables, 1970.

Isotope dilution Ar analyses are reported for all samples originally analyzed by neutron activation. The methods are in agreement but more precise and accurate isotope dilution analyses are preferred. — Author's abstract

Arnold, E. P. *See* Algermissen, S. T. 00221

00483 **Aronow, Saul.** Critical features of the Pleistocene Beaumont Clay surface in Jefferson and Chambers Counties of southeast Texas [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 334, 1970.

07976 **Arro, Eric.** Waltman Field, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 105-110, illus., 1969.

The Waltman field is a combination structural-stratigraphic trap; stratigraphic changes for the most part limit the production to the northeast. A number of essentially discontinuous fluvial-deltaic sandstones in the Tertiary lower Fort Union Formation and the Upper Cretaceous Lance Formation constitute the reservoir rocks. Of the 12 wells drilled in the unit (excluding the two Lario wells outside the field), three were dry holes. Production is mainly gas with some distillate and oil, and a trace of water. On June 1, 1969, six wells were still producing, of which two are marginal. Three wells are presently shut in. Production in April, 1969 totalled 436 bbl. oil and 280,300 MCF gas. — Author's summary

Asada, Tetsutaro. *See* Ohta, Yutaka. 00327

07931 **Ash, Sidney R.** Ferns from the Chinle Formation (Upper Triassic) in the Fort Wingate area, New Mexico: U.S. Geological Survey Prof. Paper 613-D, p. D1-D51, illus., table, 1969.

Five Late Triassic ferns which were originally described from Petrified Forest National Park, Ariz., by Daugherty in 1941 are redescribed in detail from new material and the type specimens. As a result of this work, the nomenclature of several of of the species is revised. These ferns are reported for the first time from New Mexico and from the Monitor Butte Member of the Chinle which lies below the Petrified Forest Member where the fossils were first found in the Petrified Forest. Since fossil plants were first discovered in the Chinle in 1849, progress on their study has been slow and erratic. At present the entire Chinle flora is known to contain 40 species of plant

megafossils which are referrable to 37 genera. Reinvestigation suggests that the Chinle and Newark floras are not as closely related as formerly held. — SRA

07942 **Asseez, L. Olayinka.** Lower Mississippian "radial structures" in the Michigan basin: Compass, v. 47, no. 1, p. 26-29, illus., 1969.

A detailed basin-wide study (Asseez, 1967) of five Lower Mississippian formations has revealed the existence of anticlinal structures in addition to those already known. They were observed on a map drawn on the Antrim surface. They exerted a significant influence on the depositional characteristics of the post-Antrim formations studied (Ellsworth, Bedford, Berea and Sunbury). These structures, in addition to the Howell anticline, occur in sub-parallel groupings the arrangement of which results in a roughly radial pattern. Although the configuration of the Michigan basin is highly symmetrical, and one might logically expect radial development, this is the first report of radiating elements within it. — Author's abstract

Ayre, R. S. *See* Gibson, R. E. 00268

Ayre, R. S. *See* Gibson, R. E. 00269

07920 **Ayres, L. D.; Bennett, G.; Riley, R. A.** Geology and mineral possibilities of northwestern Patrica district, Ontario: Canadian Mining Jour., v. 90, no. 4, p. 62-65, illus., 1969.

Almost all known mineral deposits are in the Precambrian Shield which is characterized by east-southeast-trending metavolcanic-metasedimentary belts, with intervening areas occupied by composite granitic batholiths. The Precambrian is unconformably overlain by Proterozoic and Paleozoic sedimentary rocks. The metamorphosed belts have been isoclinally folded, with major axes parallel to the trend, and intruded by several syenite and carbonatite stocks; the latter contain mineral concentrations. About 100 known major mineral showings contain a wide variety of mineral associations. Occurrences described are radioactive elements, gold, silver, copper, lead and zinc, iron, nickel, and molybdenum. — ESL

00224 **Babcock, Elkanah A.** Basement structure and faulting along the northeast margin of the Salton Sea [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 68, 1970.

Bachinski, Sharon W. *See* Scott, Robert B. 07865

00225 **Bailey, Edgar H.; Blake, M. C., Jr.; Jones, David L.** Character and significance of the ophiolitic oceanic crust that forms the base of the Great Valley sequence in western California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 68-69, 1970.

07879 **Bailey, S. W.** Polytypism of trioctahedral 1:1 layer silicates [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 17, no. 6, p. 355-371, illus., tables, 1969.

Topics discussed in connection with systematic derivation of 12 standard polytypes, are: interlayer shifts along *X*, no interlayer shift, interlayer shifts along *Y*, and comparison with other studies. Atomic coordinates as fractions of cell parameters for the 12 standard polytypes are tabulated under identification of polytypes, as are calculated X-ray powder patterns for standard 1:1 polytypes. Correlation of natural examples with the theoretical stacking sequences derived in this paper are discussed for dioctahedral as well as trioctahedral structures. Relative structural stabilities include a table giving a summation of structural factors that influence stability. — ESL

00226 **Baird, A. K.; Welday, E. E.; Baird, K. W.** Chemical variations in batholithic rocks of southern California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 69, 1970.

Baird, A. K. *See* Morton, D. M. 00320

Baird, K. W. *See* Baird, A. K. 00226

08156 **Baker, C. H., Jr.** (and others). Ground-water conditions in Utah, spring of 1969: Utah Div. Water Resources Coop. Inv. Rept. 7, 61 p., illus., tables, 1969.

This report contains information on well construction, ground-water withdrawals, water-level changes, related changes in precipitation and streamflow, and supplementary data related to ground-water use in some areas. Estimated total withdrawal of water from wells during 1968 was about 20,000 acre-feet less than that reported for 1967. As a result of near-normal precipitation and little change in withdrawals, water levels changed little from March 1968 to March 1969. Conditions in the major areas of ground-water development are summarized by several authors. — MCM

00484 **Baldwin, Otha D.; Adams, John A. S.** K^{40}/Ar^{40} ages of the alkalic igneous rocks of the Balcones Province of Texas [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 334, 1970.

Barazangi, Muawia. *See* Seeber, Leonardo. 07828

08073 **Barlow, James A., Jr.** (editor). Water resources investigations in Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 207-210, illus., 1969.

This is a bibliography of source material for water resource investigation in Wyoming. Most publications listed are from the U. S. Geological Survey and include three Professional Papers, 23 Water-Supply Papers, eight Circulars, and nine Hydrologic Atlas reports; numerous other miscellaneous sources are indicated. — HRC

Barlow, James A., Jr. *See* Wyoming Geological Association. 08097

Barnett, George. *See* Gisler, Patrick. 00271

08158 **Barnhisel, R. I.; Massey, H. F.** Chemical, mineralogical and physical properties of eastern Kentucky acid-forming coal spoil materials: Soil Sci., v. 108, no. 5, p. 367-372, tables, 1969.

Nearly 800,000 acres of land have been disturbed by coal-stripping operations in Appalachia, with approximately 60,000 acres in eastern Kentucky. The extreme acidity and Fe, Mn, Cu, and Zn content of the spoil materials approach toxic levels that pose problems in the establishment of plant cover. The acid-producing layers should be either buried deep within the spoil bank so that the rate of oxidation of pyrite is reduced or large amounts of limestone should be added to help neutralize the acids. — JWH

07978 **Barrett, William J.; Hubley, Myron D.** The Madden Gas Field, Fremont County, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 115-120, illus., 1969.

The Madden field is in the Wind River basin near the geographic center of Wyoming and has 200 MCF of gas in estimated reserve; the field margins are undefined to the south and west. The productive interval underlies the Waltman Shale and extends through 4231 feet of lower Fort Union sand and shale section. Multiple lenticular sands, deposited in a fluviatile environment, provide combined productive intervals averaging in excess of 200 feet of net pay. The Madden structure has a closure of less than 500 feet, and forms one of the highs on the Madden-Badwater anticline. The syncline of the south margin marks the synclinal axis of the Wind River basin. Deeper production possibilities exist. — *from* Author' summary

08121 **Barry, R. G.** The world hydrological cycle, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 11-29, illus., tables, 1969.

Facts and figures are given about many aspects of the hydrological cycle, largely summarized from published accounts. Included are figures for global water and for the components of the hydrologic cycle, evaporation, atmospheric moisture, precipitation, water circulation in the atmosphere, water circulation in the lithosphere, the global water balance, global water circulation in relation to the Earth's energy budget, and climatic change and the global water budget. — HRC

00417 **Basham, P. W.; Weichert, D. H.; Anglin, F. M.** An analysis of the 'Benham' aftershock sequence using Canadian recordings: Jour. Geophys. Research, v. 75, no. 8, p. 1545-1556, illus., tables, 1970.

The Nevada Test Site (NTS) explosion Benham caused a series of aftershocks well distributed over the magnitude range up to m 4.6. Results of an analysis of the aftershocks and other NTS explosions are reported here. The Yellowknife array ($\Delta = 25°$) and the Canadian network ($12° < \Delta < 49°$) short-period facilities can detect P waves for all aftershocks larger than m 3.6; long-period facilities can detect Rayleigh waves for all aftershocks larger than m 4.0. The M versus m and P-wave spectral ratio discriminants produce excellent separation between the larger aftershocks and similar body-wave magnitude NTS explosions. An rms scatter of about 80 km in latitude and 50 km in longitude of the Yellowknife array epicenters does not allow resolution of the real difference in aftershock and explosion locations. — Authors' abstract

Bateman, P. C. *See* Dodge, F. C. W. 00255

00429 **Bates, T. R.; Reeves, C. C., Jr.; Parry, W. T.** Late Pleistocene history of pluvial Lake Mound, Lynn and Terry Counties, Texas: Texas Jour. Sci., v. 21, no. 3, p. 245-259, illus., 1970.

The Pleistocene Tahoka Clay, of Woodfordian age, crops out around the present playa of pluvial Lake Mound, Texas. The playa is formed by a veneer of Recent debris over up to 50 feet of pre-Tahoka lacustrine strata which consists mainly of clay and sand with sporadic carbonate lenses. Drill and core holes, oxygen isotope ratios, boron paleosalinity determinations, clay mineralogy, the local pollen curve, and radiocarbon dates, indicate that the Mound Lake Dolomite Wedge formed by precipitation of primary dolomite from magnesium-rich lake brines in pre-Tahoka time, the top of the dolomite now exhibiting irregularities caused by recent springs. — Authors' abstract

Bath, Gordon D. *See* Crandell, Dwight R. 00248

08108 **Bayrock, L. A.** Incomplete continental glacial record of Alberta, Canada [with German abs.], *in* Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, p. 99-103, illus., 1969.

The Saskatchewan Gravels antedate and differ from other western Canadian and United States continental glacial deposits in that they contain no material from the Canadian Shield, underlie recognizable glacial deposits, and overlie Cretaceous and Paleocene shale and sandstone. They occur as fills in river valleys that may be correlated with Alden's (1932) bench no. 3. Recent fossil evidence suggests that they are late-Pleistocene, possibly deposited in early Wisconsin time but before the Wisconsin ice sheet had spread into this region. The fact that they occur throughout Alberta and parts of Saskatchewan, shows that early glaciers did not cover these areas. — *from* Author's abstract

07886 **Beardsley, John W.** A new fossil scale insect (Homoptera: Coccoidea) from Canadian amber: Psyche, v. 76, no. 3, p. 270-279, illus., table, 1969.

The only previously described Mesozoic coccid fossil, an impression, is from the Soviet Union. The specimen described and figured is preserved in amber of Upper Cretaceous age, from Cedar Lake, Manitoba; it is an adult male in a relatively good state of preservation, a new species and genus, *Electrococcus canadensis*. Morphological features are compared with other male Coccoidea, and its relationship to extant specimens is discussed. — ESL

08026 **Beasley, Charles Alfred.** The conversion of mineral resources to mineral reserves — General and specific process models and a comparative case-study [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2732B, 1969.

08131 **Beckinsale, Robert P.** River regimes, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 455-471, illus., 1969.

The regime of a river and the variations in its discharge are controlled by several factors: especially climate, vegetation, soils, rock structure, basin morphometry, and hydraulic geometry. Of these, only rock structure, and to a lesser extent, basin size can be strictly independent of climate. Hydrological regions, or areas characterized by certain types of streams, are areas within which local and regional river regimes reflect the regional climatic rhythm, and differentiation is possible. There are, in general, four climatic types: tropical rainy; dry; warm, temperate rainy; and cold, snowy climates. Further, subdivisions based on runoff can be recognized. Other categories based on mean high and low month are recognized also. — HRC

07951 **Beeton, A. M.** Changes in the environment and biota of the Great Lakes, *in* Eutrophication — Causes, consequences, correctives — Symposium [1967], Proc.: Washington, D.C., Natl. Acad. Sci., p. 150-187, illus., table, 1969.

Changing fish populations are obvious effects of man in the Great Lakes region; more subtle are increases in chemical content of water, more abundant plankton, and changes in the benthos. Lake Erie, in the most populous basin, has had the greatest changes in ecology; from here in part stem parallel changes in Lake Ontario. The larger lakes show more gradual changes. Concern is not new, but limnology has been extensively studied only in the past 15 years. Major environmental changes are related to long-term sediment changes, especially in Lake Erie; chemical character of Lake Superior water has remained about the same since 1886, except for some littoral increase in phosphorus. High-quality water from Lake Huron flowing through Lake Erie could theoretically change it completely in 3 years, if pollution was abated. Many polluted streams enter Lake Michigan which has a small flow-through. — GDC

08189 **Bendix-Almgreen, Svend E.** Notes on the Upper Cretaceous and lower Tertiary fish faunas of northern West Greenland [with Danish summ.]: Dansk Geol. Foren. Medd., v. 19, no. 2, p. 204-217, 1969.

Elasmobranchs and actinopterygians collected from several localities in northern West Greenland are reported; full descriptions will be published later. Elasmobranch and invertebrate faunas indicate different ages for the Kangilia and Agatdal Formations. Close similarity between the selachoid faunas of the Kangilia and of the lower and middle Danian of Dano-Scania suggests that the two regions were parts of the same ocean in early Danian time. The selachoids and batoids of the Agatdal show close similarity to upper Paleocene faunas of Europe and North Africa and more remote affinity to the Aquia Formation fauna of eastern North America, supporting the hypothesis of Paleocene migration of the northern Nearctic fauna toward the southeast, and also a more restricted migration to the southwest. — VMJ

Bennett, G. *See* Ayres, L. D. 07920

07954 **Benoit, Richard J.** Geochemistry of eutrophication, *in* Eutrophication — Causes, consequences, correctives — Symposium [1967], Proc.: Washington, D.C., Natl. Acad. Sci., p. 614-630, illus., tables, 1969.

Solubility equilibrium theory can account for the behavior of elements in the weathering of rocks and for the general composition of surface waters. For some elements, sorption phenomena which seem to dominate their fate in water require careful quantitative study. Nuisance species of algae evolved before man began to affect the environment significantly, as did agricultural weeds. Man now seems to be the dominating force in the geochemical economy of many lakes and rivers. Both laboratory experiments on cultural characteristics of planktonic algae and field experiments, in which the chemistry of lakes is deliberately altered, can shed light on factors that limit productivity or alter the trophic state of a lake. — *from* Author's conclusions

00227 **Berg, Henry C.** Paleozoic plutonism and contrasting metamorphic terranes, Annette Island, Alaska [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 70, 1970.

00228 **Berkland, James O.** New occurrence of Tertiary marine strata indicates middle to late Miocene age for the Quien Sabe volcanics of Pacheco Peak, Santa Clara County, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 71, 1970.

08046 **Berman, David S.** Vertebrate fossils from the Lueders Formation, Lower Permian of north-central Texas [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2955B, 1969.

Berry, F. A. F. *See* Turner, D. L. 00382

00229 **Berry, Michael J.** Deconvolution of refraction records obtained during Project Edzoe [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 71, 1970.

00230 **Berry, William B. N.** Depositional environment of some Silurian graptolite-bearing rocks in Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 72, 1970.

07922 **Bidgood, D. E. T.** Salt intrusions and associated minerals — Nova Scotia: Canadian Mining Jour., v. 90, no. 4, p. 73-74, 1969.

Mineral exploration has been dominated by the search for oil and gas and placer gold in the offshore area. Cape Breton has been the main area of activity in the search for new salt deposits which occur in the Windsor succession. The salt has flowed and formed intrusions controlled by faults; gravity surveys have been used to detect buried deposits. The Windsor succession is incomplete because of salt solution and flow. Other evaporites also occur, especially potash. — ESL

07965 **Biehler, Shawn; Bonini, William E.** A regional gravity study of the Boulder batholith, Montana, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 401-422, illus., tables, 1969.

The gravity anomaly pattern in southwestern Montana indicates that the Boulder batholith is approximately symmetrical about a northeast-trending axis paralleling the length of the present outcrop. The axis of the -40 mgal anomaly is 25 km northwest of the axis of the outcrop but would coincide with the center of the intrusive were the covering volcanics removed. Calculations indicate that the bottom of the anomalous mass is less than 15 km deep and concave upward. Six configurations are postulated for the shape of the intrusive. The western extent of the gravity low is indefinite, and, therefore, the intrusive rocks underlie a considerable area to the west of the outcrop, in the vicinity of Phillipsburg, Montana. There is no geophysical evidence for a sharp structural delineation between the Idaho and Boulder batholiths. The relation of the outlying stocks to the Boulder batholith is discussed on the basis of the geophysical evidence. — *from* Authors' abstract

Bird, John M. *See* New England Intercoll. Geol. Conf. 07808

00407 **Bissell, H. J.** Realms of Permian tectonism and sedimentation in western Utah and eastern Nevada: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 285-312, illus., tables, 1970.

Permian sediments in eastern Nevada and western Utah were deposited between the Antler-Sonoma orogenic belt (west) and the Utah-Wyoming shelf (east). Maximum thickness, 17,000 feet, is in the Oquirrh basin of northwestern Utah. Three Permian depocenters from western sources, forming a north-to-south chain in eastern Nevada, contain 10,000, 9,000, and 6,000 feet of Permian rocks, respectively. The fossiliferous rocks are mostly orthoquartzite of Wolfcampian, Leonardian and Guadalupian ages. Rocks contain hydrocarbons, but the area is structurally complex, testing is costly, and production has not yet been too rewarding. Stages of Permian deposition are illustrated by isopach and lithofacies maps. — BHK

08094 **Black, Craig C.** Fossil vertebrates from the late Eocene and Oligocene, Badwater Creek area, Wyoming, and some regional correlations, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 43-47, tables, 1969.

Three distinct fossil levels are recognized in the Eocene Hendry Ranch Member of the Tepee Trail Formation; they include 56 genera from 5 different locations. Nineteen species from a late Oligocene deposit, the Cedar Ridge local fauna, are listed also. Considering the nature of the enclosing rocks, it now seems certain that aggradation in the Wind River basin had commenced by late Oligocene time along the northern rim. Radioactive dating of some of the tuffs between the faunal layers does not correlate well with the fauna; however, the rates of accumulation of strata were different in different places and the faunas and tuffs need not be contemporaneous. — HRC

08185 **Black, Craig C.** The fossil rodent genera *Horatiomys* and *Palustrimus* — Juvenile geomyoid rodents: Jour. Mammalogy, v. 50, no. 4, p. 815-817, 1969.

The relationships of two rodent genera, described in 1935 by Wood, are clarified. Each was originally based on a single specimen, *Palustrimus* on one tooth, and *Horatiomys* on a mandible with one tooth. The type specimen of the latter found near Fort Logan, Mont., in the Miocene Deep River Formation, was assigned to the family Cricetidae, but the author believes it is more similar to *Dikkomys woodi*, a geomyid. *Palustrimus* was originally described as a member of the Muridae, but it has been pointed out that the teeth are associated with numerous entoptychine pre-molars and molars, and no murids are known from the New World. The author recommends that *Horatiomys montanus* be considered a synonym of *Dikkomys woodi*, a member of the Geomyidae, and that *Palustrimus* be considered a member of the Geomyidae and be placed in the synonomy of *Entoptychus*. — ESL

07782 **Black, Robert F.** Geology, especially geomorphology, of northern Alaska, *in* U. S. Naval Arctic Research Lab. Dedication Symposium, Fairbanks, Alaska, 1969, Proc.: Arctic, v. 22, no. 3, p. 283-299, illus., 1969.

An attempt has been made to categorize the general geomorphic studies in northern Alaska. The artificial grouping does not permit the recording of numerous geomorphic observations included incidentally in many reports on file at the library of the Naval Arctic Research Laboratory but not published. Some have attempted to summarize all or at least many regional and topical aspects, including processes, of the geomorphology of northern Alaska. — Author's conclusions

Blackford, M. E. *See* Major, M. W. 00307

Blake, M. C., Jr. *See* Bailey, Edgar H. 00225

00231 **Blake, M. C., Jr.** Different facies in Franciscan rocks and their significance in the late Mesozoic history of western California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 73, 1970.

Blanchard, M. B. *See* Cunningham, G. 00249

08008 **Bock, Wilhelm.** The American Triassic flora and global distribution — Geol. Center Research Ser., V. 3-4: North Wales, Pa., Geol. Center, 406 p., illus., 1969.

Triassic plants of the United States are systematically described: algae, 6 genera, 6 species (2 new); fungi, 3 genera (1 new), 7 species (4 new); pteridophytes, 23 genera (5 new), 34 species (15 new), notably Isoetales, Equisetales, and Cyatheaceae; gymnosperms, 22 genera (10 new), 70 species (28 new), notably Cycadophyta, Ginkgophytina, and Coniferophytina. The western floral province occupies the Colorado Plateaus; the eastern, from Massachusetts to North Carolina, includes the Newark Basin. World distribution of higher plants is summarized in relation to temperature belts for each geological period. Dispersal routes of Triassic plants are traced and floral provinces are correlated, with emphasis on differences between floras of the

Northern and Southern hemispheres. There are also chapters on principles of dichotomous growth and on pathology of Triassic plants. — VMJ

07887 **Bolke, E. L.; Price, Don.** Hydrologic reconnaissance of Curlew Valley, Utah and Idaho: Utah Dept. Nat. Resources Tech. Pub. 25, 40 p., illus., tables, 1969.

The Utah part of Curlew Valley (Utah subbasin) covers about 550 square miles of an arid to semiarid, largely uninhabited area. The main source of water is the ground-water reservoir in the valley fill. Confined aquifers in alluvial and lacustrine deposits and intercalated volcanic rocks in the fill yield several hundred to several thousand gpm to individual large-diameter irrigation wells west of Snowville and near Kelton, where annual ground-water pumpage is reflected in water-level declines. Annual recharge is about 40,000 acre-feet, mostly from underflow from the Idaho part of Curlew Valley. Most ground water in the western subbasin is suitable for domestic supply and irrigation, some in the eastern part is not suitable; most water in the valley can be used for stock purposes. — *from* Authors' abstract

Bollin, E. M. *See* Simmonds, P. G. 08056

07829 **Bollinger, G. A.** Central Appalachian seismicity and seismic travel times [abs.]: Earthquake Notes, v. 40, no. 4, p. 10-11, 1969.

Bolt, Bruce A. *See* Cluff, Lloyd S. 07858

Bonini, William E. *See* Biehler, Shawn. 07965

00232 **Bostick, Neely H.** Measured alteration of organic particles (phytoclasts) as an indicator of contact and burial metamorphism in sedimentary rocks [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 74, 1970.

07930 **Boström, Kurt; Valdes, Sylvia.** Arsenic in ocean floors: Lithos, v. 2, no. 4, p. 351-360, illus., tables, 1969.

A total of 66 pelagic sediments, 1 Red sea hot brine sediment, and 9 basic and ultrabasic deep sea rocks have been analyzed for As. All the highest As values in sediments are found on or close to active oceanic ridges. Average As content of pelagic sediments is estimated to be 40 ppm on a carbonate free basis. The content of As in oceanic rocks is low. The enrichment of As in deep sea sediments can be best explained as an adsorption process on colloidal matter. The source for As is probably, besides continental weathering products, emanations of deep seated origin on the active ridges. — Authors abstract

Boul, S. W. *See* Daniels, R. B. 07935

Bowes, D. R. *See* Langer, Arthur M. 07963

Bowin, Carl O. *See* Rosenfeld, Melvin A. 07907

07977 **Boyd, John B.** Cooper Reservoir Field, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 111-114, illus., 1969.

Gas accumulation occurs at Cooper Reservoir on a north-plunging nose which has approximately 45 feet of closure at Fort Union producing depth. All horizons, down to and including the Lance Formation, have been evaluated. Production is from the lower Fort Union fluvial section where three separate sand reservoirs, each with a separate gas-water contact, are present. Five wells have been drilled, with two completed gas producers. Productive limits of the field are defined by gas-water contacts on one side and by indicated steep dip on the other. Approximately 776 acres are proven with 3200 MMCF gas produced to May, 1969. — Author's summary

Boyer, Robert E. *See* Dupré, William R. 00485

07840 **Boyer, Robert E.** Earth science for eighth grade — A college-school cooperative project [abs.]: Texas Jour. Sci., v. 20, no. 3, p. 286-287, 1969.

07923 **Boyle, R. W.** The source of elements in epigenetic mineral deposits — A metallogenetic concept for prospecting, *in* Guidelines to prospecting — A symposium: Canadian Mining Jour., v. 90, no. 4, p. 104-107, illus., tables, 1969.

The epigenetic deposits discussed are those of copper, silver, gold, zinc, cadmium, tin, lead, arsenic, antimony, uranium, molybdenum, and tungsten. Principal factors involved in concentration of elements in epigenetic deposits are summarized. Geochemical studies have shown that sediments, volcanic rocks, and the metamorphic rocks derived from them, are a great reservoir of practically all elements in epigenetic deposits; rocks enclosing the deposits might be the source. Trace and minor elements in some Canadian sulfide schists, graywackes, etc., those in marine organisms, and in Canadian volcanic rocks, are tabulated. Schematic examples of concentration in some types of structure are described. Steps in prospecting are: identify source rocks, identify receptacle rocks, and carry out geochemical and geophysical surveys along belts of favorable receptacle rocks. — ESL

Brabb, Earl E. *See* Brosgé, William P. 00469

Brackin, W. P. *See* Langenheim, R. L., Jr. 00303

Bratt, Judy M. *See* Swain, Frederick W. 00437

00424 **Bray, Martha Coleman.** Joseph Nicolas Nicollet, geologist: Am. Philos. Soc. Proc., v. 114, no. 1, p. 37-59, illus., 1970.

Briggs, D. Z. *See* Briggs, L. I. 07899

07899 **Briggs, L. I.; Briggs, D. Z.** Stratigraphic analysis, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 13-39, illus., table, 1969.

The sequence of defined stratigraphic terms constructs the levels of the structure in the stratigraphic system network; each level is composed of groups, sets, subsets, and elements having defined values of stratigraphic information. Structuring of this information arises through relative measurements, evaluation of derived measurements, and development of functional stratigraphic classifications. Classification and grouping is accomplished by explicitly defining elements of stratigraphic categorization and assigning information value to their associations which are functionally classified; lithologic parameters are defined through associative classification groups, leading to derived patterns, facies, and paleogeographic settings. This is a feedback system involving each defined stratigraphic element on all integrated levels of information concepts. Lithologic parameters of the analysis are modeling parameters of the simulation model system. — *from* Authors' abstract

Brisse, François. *See* Knop, Osvald. 08002

Broenkow, William W. *See* Conomos, T. John. 00247

00233 **Brogan, George E.; Slemmons, David B.** Late Quaternary fault patterns along the Death Valley-Furnace Creek fault zones, Death Valley and Fish Lake Valley, California and Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 74-75, 1970.

00462 **Brookins, D. G.; Voss, J. D.** Age dating of muscovites from Pennsylvanian sandstones near Wamego, Kansas: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, 1970.

Channel and sheet sandstones characterize the nonmarine phase of a typical cyclothem of the Pennsylvanian of eastern Kansas and, near Wamego, Kansas, a channel sandstone cuts a sheet sandstone of the Willard Shale (Upper Pennsylvanian). K-Ar and Rb-Sr dates on muscovite from these two sandstones agree within the limits of error, and indicate a common Devonian source for the sand. — *from* Authors' abstract

00469 **Brosgé, William P.; Brabb, Earl E.; King, Elizabeth R.** Geologic interpretation of reconnaissance aeromagnetic survey of northeastern Alaska: U. S. Geol. Survey Bull. 1271-F, p. F1-F14, illus., 1970.

Aeromagnetic reconnaissance of northeastern Alaska in 1965 covered 100,000 sq mi, from lat 64° N. to the Arctic Ocean and from the Alaska-Yukon boundary to long 148°30′W. On the basis of a magnetic contour map, compiled from data from this and earlier surveys, northeastern Alaska may be divided into five areas, each having a distinct magnetic character. A study of specific anomalies within these areas led to the tracing of the Tintina fault zone, Ruby uplift, and Kobuk trench for more than 100 miles. Other features, such as inferred north-trending faults and serpentine belts, had not been identified previously by surface geologic methods. The probable extension of volcanic rocks beneath Yukon Flats limits the size of a possible Tertiary petroleum basin. Large magnetic anomalies in the Yukon-Tanana Upland provide possibilities of mineral deposits associated with ultramafic rocks. — *from* Author's abstract

07783 **Brotherton, Miner K.; Sadowski, Bernard S.** Seismic velocity determinations of Pn for near earthquakes in the vicinity of Vancouver Island: Acta Geophys. Polonica, v. 17, no. 3, p. 215-220, illus., tables, 1969.

A total of 18 near earthquakes with epicenters in the vicinity of Vancouver Island were investigated, using Victoria, B. C. as the base station. Twelve epicenters off the west coast of the island have a general bearing of 330° True. Six epicenters located within 140 km of Victoria were selected in order to determine P and S velocities for Poisson's ratio calculation. Traveltime curves were constructed and a Pn velocity of 7.93 kmps was determined by a linear least squares fit of data points. Similar procedures gave velocities of 7.19 kmps for P and 4.03 kmps for S. Poisson's ratio for the lower crustal layer was found to be 0.27. Pn intercept time was used to estimate a maximum depth to Moho of 25.5 km. — Authors' abstract

Broussard, W. L. *See* Hosman, R. L. 00450

07919 **Brown, A. S.** Distribution of metallic mineralization in British Columbia: Canadian Mining Jour., v. 90, no. 4, p. 49-53, illus., 1969.

This note summarizes the salient points in a recent article by the author (1969), amplifies some others, and includes several new diagrams and a brief review of some of the most important developments. The five tectonic belts in the province are described, and their relation to mineral distribution discussed. Mineralized zones and intensity are shown on maps. — ESL

08027 **Brown, Dwight Alan.** Erosion and morphometry of small drainage basins in eastern Puerto Rico [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2754B-2755B, 1969.

Brown, Frederick S. *See* Kvenvolden, Keith A. 00300

Brown, Robert D. *See* Algermissen, S. T. 00222

07818 **Brown, Severn P.; Cutcliffe, William E.** Applied geology in the central Hudson Valley, Trip 17 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 17-1 — 17-9, 1969.

A field trip of 63 miles describes geological observations en route. Two stops are made, one in a quarry which exposes a section from the Normanskill through Kalkberg Formations and the second at the Hudson Cement Company plant in Kingston, New York. Details of the cement operation are included as are details of the stratigraphy and structure of the quarry. All units from the Normanskill through Esopus are present in the most complex (structurally) quarry in the region. The chief purpose of the trip is to emphasize the use of geology in the cement industry in the Hudson valley. — HRC

00234 **Brune, James N.** Tectonic stress and the spectra of seismic shear waves from earthquakes [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 75, 1970.

00455 **Bruun, P.** Use of tracers in harbor, coastal and ocean engineering: Eng. Geology, v. 4, no. 1, p. 73-88, illus., table, 1970.

This paper describes the use of tracers in various engineering fields including ocean, harbour, coastal and river engineering and some special applications of tracers, e.g., in pollution control. Introductory, it mentions certain pertinent aspects of tracer technology and methods of analyses to determine drift pattern and quantity. A list of references and a special bibliography is included, the latter giving examples of literature on actual tracer projects in various fields of science and technology. [Examples of tracers use are given, including several places in California, Atlantic coastal areas, Lake Superior, and Jamaica.] — Author's abstract

00470 **Bryant, Leonard C.** West Terryville field, Dewitt County, Texas: South Texas Geol. Soc. Bull., v. 10, no. 5, p. 6-12, illus., table, 1970.

The West Terryville field, a shallow gas discovery in the Yegua sand has nine producing gas completions. An electrical induction log shows the pay section with present nomenclature. The productive sands in one field are low in resistivity but the Rwa log indicates they are hydrocarbon bearing. The field is a low relief anticlinal structure traversed by a down-to-the-coast fault that limits production to the southeast. The field is producing at the rate of about 300 million cubic feet of gas per month. — MCM

00235 **Buchbinder, Goetz G. R.** Direction of initial motion of PcP [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 76, 1970.

08095 **Buddington, A. F.; Jensen, M. L.; Mauger, R. L.** Sulfur isotopes and origin of northwest Adirondack sulfide deposits, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 423-451, illus., tables, 1969.

The pyrite deposits in the Grenville Series of the northwestern Adirondacks are conformable and are restricted to certain stratigraphic zones; graphite is a consistent accessory; trace-element characteristics are typical of sedimentary pyrite. Massive pyritic zones contain isotopically light sulfur. The deposits are inferred to have initially been bacterial, sedimentary-diagenetic in origin. The pyrite-bearing rocks have been metamorphosed regionally to the almandine-amphibolite facies and hornblende granulite subfacies. Most host rocks are migmatitic gneisses; those near the pyrite zones have been hydrothermally altered. Dravite is present in concentrations to several percent in some pyrite deposits. The pyrite deposits have undergone a three-stage history: sedimentation-diagenesis, high-grade metamorphism, and hydrothermal alteration. — *from* Authors' abstract

00236 **Budge, David R.** Paleoecology of Late Ordovician and Silurian corals, eastern Great Basin [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 76, 1970.

00237 **Bull, William B.** Effect of climatic and tectonic changes on denudation rates in part of the Diablo Range, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 77, 1970.

Bullock, W. D. *See* Rana, M. H. 07927

00238 **Burke, Dennis B.** Permo-Triassic non-marine deposition and coeval block faulting, west-central Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 77-78, 1970.

00239 **Burke, Dennis B.** Reinterpretation of the "Tobin Thrust", west-central Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 78, 1970.

00445 **Burke, J. J.** Some ornamented erisocrinids from the Ames Limestone: Kirtlandia, no. 9, 17 p., illus., 1970.

Three new erisocrinid inadunate crinoid species, all ornamented, are described from the Ames Limestone, Conemaugh Group, Pennsylvanian. *Delocrinus brookensis*, from Brooke County, W. Va., is more specialized than *D. tulsaensis* (Strimple) from the Desmoinesian of Oklahoma, but is probably a derivative of it. *Endelocrinus pennsylvanicus*, from Allegheny County, Pa., is the largest Pennsylvanian form of the genus and is characterized by spine-bearing primibrachs. *Paradelocrinus decoratus*, from Brooke County, W. Va., in addition to being ornamented, is relatively large, but otherwise fairly typical of the genus. Knapp's (1969) proposal of Declinida, a new order for forms, removed from Cladida, with a dorsal cup having a basal concavity, is opposed for lack of adequate evidence. — *from* Author's abstract

07994 **Burlingame, A. L.; Wszolek, Patricia C.; Simoneit, Bernd R.** The fatty acid content of tasmanites, *in* Advances in organic geochemistry 1968 — Internat. Mtg., 4th, Amsterdam, 1968, Proc.: Oxford, England, and New York, Pergamon Press (Internat. Ser. Mons. Earth Sci., V. 31), p. 131-155, illus., tables, discussion, 1969.

Alaskan tasmanite, an organic-rich sedimentary rock of Late Jurassic to Early Cretaceous age, is almost entirely compressed discs of unicellular *Tasmanites* thought to be fossil green algae. Investigation of its fatty acid content by gas chromatography and mass spectrometry reveals several interesting series of carboxylic acids and some aromatic acid types. Five successive procedures to isolate tasmanite acids included: ultrasonic solvent extraction, Soxhlet extraction, ultrasonic extraction after demineralization, and saponification and oxidation of the kerogen. Differences in the five acid ester distribution patterns probably reflect the solubilities of the acids and the way they are bound in the sediment. Permian tasmanite from Tasmania has only half the organic content of the Alaskan sediment, as determined by the same extraction procedures. — GDC

07788 **Bushinskiy, G. I.** Formatsiya Fosforiya: Akad. Nauk SSSR Geol. Inst. Trudy, no. 201, 102 p., illus., 1969.

This monograph, compiled chiefly from American sources, summarizes the geology of the Phosphoria Formation and, based on petrographic and paleogeographic data, analyzes the origin of its phosphorites. The author cites the predominance of phosphate pellets over oolites, cement, and phosphatic and phosphatized organic remains and concludes that they are coprolites, phosphatized in the mud of shallow seas. From his analysis of regional lithofacies relations, supplemented by data based on the phosphate-bearing capacity of the Volga River, he also concludes that sand, clay, carbonates, phosphate and silicon were brought in from the north by an ancient river and deposited in a semi-closed basin. The maximum phosphate accumulation occurred in the area of transition from sandy-clayey into clayey rocks. — VEMcK

07774 **Butler, B. Robert.** The earlier cultural remains at Cooper's Ferry: Tebiwa, v. 12, no. 2, p. 35-50, illus., table, 1969.

The earlier cultural remains at Cooper's Ferry, Idaho, though few in number, suggest a long and continuous cultural sequence in the Grave Creek-Rocky Canyon locality dating back perhaps 12,000 years to the end of deglaciation in eastern Washington and northern Idaho. This sequence may embrace an overlapping series of cultural patterns that are ordinarily thought of either as unrelated or as only distantly related. In an excavation of 1964, a section of 11 layers is described, the lowest, a terrace deposit, containing cobbles coated and cemented with calcium carbonate resting on and mixed in with a loose subangular basalt gravel. Filling depressions in its surface, possibly roasting ovens, is "dune" sand in which the earliest artifacts occur. No

radiocarbon sample of sufficient size for dating was recovered, so the antiquity based on geological and cultural comparisons is open to question — GDC

Butler, David. *See* Major, M. W. 00307

07960 **Butler, James Robert.** Origin of Precambrian granitic gneiss in the Beartooth Mountains, Montana and Wyoming, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 73-101, illus., tables, 1969.

Four basically different models are evaluated for origin of granitic gneiss in this area: sedimentary-volcanic depositional, magmatic, anatectic, and metasomatic, as well as a combined magmatic-metasomatic model. Depositional and anatectic models are inadequate to explain field relations and rock composition. The magmatic model is plausible only if magma injection takes place over hundreds of square miles and thousands of vertical feet without disturbing homogeneity of fabric and conformable contacts. Rounded zircons are evidence against the magmatic model. If gradational sequences are explained by reaction between magma and country rock, disposal of elements, that are not needed, becomes a problem. The metasomatic model explains many relations, but little evidence is available on source of material or transport mechanism. Metasomatism is probably the dominant process, but others, particularly a combination of synkinematic magmatism and metasomatism, are possible. — *from* Author's abstract

Byrne, J. G. *See* Franzmeier, D. P. 07863

Cady, W. M. *See* Tabor, R. W. 00377

08164 **Cailleux, André.** Les remaniements cycliques de l'écorce terrestre [discussion of "Sedimentary rock types. . ." by R. M. Garrels and F. T. Mackenzie, 1969]: Sci. Progrès Decouverte, no. 3416, p. 479-480, illus., 1969.

Garrels and Mackenzie (Science, v. 163, no. 3867, p. 570-571, 1969) have suggested that variation in proportions of sedimentary rock types in the geologic column result chiefly from differential rates of deposition and erosion of various components of the sedimentary mass; from Precambrian time, replacement of total sediment mass, assumed to be constant with time, is based on a model of five cycles. W. Niewenkamp (1956, 1968) and others have arrived at similar conclusions from calculations of present thickness of the continental crust and present rates of continental erosion and marine sedimentation extrapolated into the past, and from the concept of reincorporation of sediments into the crust as metasedimentary and igneous rocks. If the continental crust was thinner in the past, or if the rate of erosion was higher, then more cycles would be required. — VMJ

Calandro, J. J. *See* Hosman, R. L. 00450

07998 **Caldwell, R. L.; Mills, W. R.; Givens, W. W.** Advances in nuclear geophysical methods in oil geology and rock analysis, *in* Nuclear techniques and mineral resources — Symposium, Buenos Aires, 1968, Proc.: Vienna, Austria, Internat. Atomic Energy Agency, p. 397-413, illus., tables, discussion, 1969.

A combined neutron method, using a pulsed accelerator source of 14-MeV neutrons and measurement of prompt, capture, and activation gamma-rays and thermal and epithermal neutron die-away, has led to the new technique of cyclic neutron activation applicable to lunar surface analysis, borehole logging, and on-stream analysis of rocks and minerals. The detector resolution of 0.5 percent at 1.3 MeV is an order of magnitude better than for a good sodium iodide detector. Gamma-rays arising from inelastic scattering of fast neutrons, capture of fast and slow neutrons, and activation were studied. Activity in the United States in commercial nuclear logging is summarized, and a new small-diameter pulsed accelerator neutron tool for logging through 2.5-in. tubing, and a pulsed neutron source using a plurality of alpha sources and beryllium targets are described. — *from* Authors' abstract

00423 **California Dept. Water Resources.** Ground water quality, App. E *in* Hydrologic data, 1968 — V. 5, Southern California: California Dept. Water Resources Bull. 130-68, v. 5, app. D-F, p. 59-169, illus., tables, 1970.

Ground-water quality data collected during water year 1968 are presented from approximately 1,500 wells in southern California. Mineral and trace-element analyses of ground water are tabulated. — MCM

07817 **Cameron, Barry.** Stratigraphy of upper Bolarian and lower Trentonian limestones — Herkimer County, Trip 16 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 16-1 — 16-29, illus., 1969.

A sixty-five mile field trip with 7 well-described stops is designed (1) to demonstrate the stratigraphic succession and its lateral variations, (2) to evaluate age relations of the various formations by the faunal diversity and lateral continuity, (3) to examine the disconformity along the Black River-Trenton boundary, and (4) to examine and evaluate the criteria for determining the environments of deposition and paleogeography. — HRC

Campbell, J. Frisbee. *See* Moberly, Ralph, Jr. 08175

00408 **Campbell, John A.** Stratigraphy of Chaffee Group (Upper Devonian), west-central Colorado: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 313-325, illus., table, 1970.

The Late Devonian Chaffee Group was deposited as shallow marine, brackish, and tidal mud-flat sediments in west-central Colorado. The Parting Formation that comprises the lower part of the Chaffee Group is composed in ascending order of quartzose sandstone, shale, thin dolomite, shale, sandy dolomite, quartzose sandstone, sandy shale, and sandy dolomite. To the east and northeast all the units change in facies to quartzose sandstone toward the source of sediments in a crystalline highland. The Dyer Formation that comprises the upper part of the Chaffee Group can be divided into two carbonate members. The lower member consists of dark-gray, dolomitic, fossiliferous limestone, and herein is named the Broken Rib Member. The upper member consists of light-gray dense, stromatolitic dolomite, and herein is named the Coffee Pot Member. — HWR

00395 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheet 43, Ontario-District of Keewatin: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1970.

00396 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheet 66, 76, District of Mackenzie-District of Keewatin: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1970.

00397 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheet 72, Saskatchewan-Alberta: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1970.

00398 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheet 82, British Columbia-Alberta: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1970.

00399 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index sheet 86, 96, District of Mackenzie: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1970.

07943 **Cannon, Philip Jan.** The physiography of southwestern Oklahoma: Compass, v. 47, no. 1, p. 23-25, 1969.

Climate, structure, permeability, and homogeneity are the basic factors influencing the physiography of southwestern Oklahoma. The haystack areas of Greer and Beckham Counties exhibit true badland topographies. — Author's abstract

08146 **Cantwell, R. J.** Fossil *Sigmodon* from the Tusker locality, 111 Ranch, Arizona: Jour. Mammalogy, v. 50, no. 2, p. 375-378, illus., 1969.

Teeth and jaws, 385 specimens, representing a minimum of 76 individuals, were uncovered from a single deposit of Pleistocene age. Study of the fossils, referred to *Sigmodon minor*, indicates a greater range of size, and variation of occlusal pattern than has been reported previously in a single fossil population. These are discussed in some detail. — ESL

00240 **Carder, D. S.** Trans-California seismic profile — Owens Valley to Monterey [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 78, 1970.

07835 **Carder, D. S.** Two unreversed seismic profiles — Nevada Test Site to the Pacific Ocean — A progress report [abs.]: Earthquake Notes, v. 40, no. 4, p. 16-17, 1969.

Carleton, Barbara J. *See* Nagata, Takesi. 08177

00241 **Carlson, Paul R.; McCulloch, David S.; Peterson, David H.; Castle, Robert W.** Comparison of acoustic reflectors and bore hole lithologies — Southern San Francisco Bay [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 78-79, 1970.

Carlson, Paul R. *See* Conomos, T. John. 00247

08100 **Carlston, Charles W.** Longitudinal slope characteristics of rivers of the Midcontinent and the Atlantic East Gulf Slopes: Internat. Assoc. Sci. Hydrology Bull., v. 14, no. 4, p. 21-31, illus., 1969.

Rivers of the Midcontinent and Atlantic and East Gulf Slopes show five types of longitudinal profiles: overall concave-upward with or without long constant slope segments; convex upward (Missouri River, convex upward with constant slope segments from above lower 560 mi to a point beyond the Yellowstone River junction); concave-upward irregular, ungraded, low-gradient profiles (Ohio and Tennessee Rivers); irregular unsegmented and steep profile (Delaware and Savannah-Tugaloo Rivers); and irregular ungraded, steep-gradient profiles that are concave-upward in upstream reaches and convex-upward downstream (most Atlantic Slope and East Gulf Slope rivers above Fall Line). Constant slope profiles occur where the latter flow across relatively weak Coastal Plain sediments or inland on Coosa and Oostanaula-Conasauga Rivers. These profiles support multiple erosion cycles in the Appalachians. — *from* Author's abstract

Carson, D. J. T. *See* Muller, J. E. 07926

07959 **Casella, Clarence J.** A review of the Precambrian geology of the eastern Beartooth Mountains, Montana and Wyoming, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 53-71, illus., geol. map, 1969.

The mountains consist of a Precambrian crystalline core uplifted during the Laramide orogeny. Rock types include microcline-rich and microcline-poor granitic gneiss, migmatite, biotite gneiss, para- and orthoamphibolite, ultramafic and mafic igneous rocks, and various quartzites and schists. A cordierite-amphibolite facies of the Abukuma-type metamorphism has been reached for relict sedimentary rocks that escaped metasomatism. K and Na metasomatism is evident. All rocks were deformed by passive folding along north- or northeast-trending axes, and some are traceable for more than 5 miles. Folding was contemporaneous with metamorphism; a two-phase history may be present. Consistent radiogenic dates suggest metamorphism was about 2,750 m.y. ago, but other dates suggest a polymetamorphic history for the range. — *from* Author's abstract

Castelliz, Lotte. *See* Knop, Oswald. 08002

Castle, Robert W. *See* Carlson, Paul R. 00241

Cater, F. W. *See* Hopson, C. A. 00288

07841 **Chandler, Ekillis M.; Crawford, Paul B.** Activation analysis of oilfield cores [abs.]: Texas Jour. Sci., v. 20, no. 3, p. 287, 1969.

00242 **Chandra, Umesh.** Comparison of focal mechanism solutions obtained from P and S wave data [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 79, 1970.

00243 **Chandra, Umesh.** Correction for focal mechanism in body wave magnitude determination [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 79-80, 1970.

08165 **Chang, Ting Pao.** Statistical analysis of meandering river geometry [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2711B, 1969.

00435 **Chipping, David H.** Late Cretaceous and Eocene paleogeography of the La Panza, southern Santa Lucia, and Sierra Madre Ranges, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 80, 1970.

00405 **Choquette, Philip W.; Pray, Lloyd C.** Geologic nomenclature and classification of porosity in sedimentary carbonates: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 207-250, illus., tables, 1970.

This article reviews current nomenclature of porosity in sedimentary carbonates, adds some new terms, and proposes a new classification. Three events which are bases for dating origin and modification of porosity are: creation of sedimentary framework (final deposition), passage of deposit below zone of major influence by processes relating to depositional interface, and passage of sedimentary rock into zone of influence by processes operating from an erosion surface (unconformity). Much porosity can be differentiated into early burial (eogenetic), intermediate (mesogenetic), and late (telogenetic) stage. These terms are also applicable to process, zones of burial, and resultant porosity. Proposed classification is descriptive and genetic, and includes 15 basic porosity types and modifying terms based on genesis, size and shape, and abundance of porosity. Examples of porosity types are illustrated, and glossary of porosity terms appended. — EGS

08123 **Chorley, R. J.** The drainage basin as the fundamental geomorphic unit, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 77-99, illus., 1969.

Slope wash and direct erosion by streams are parts of a larger system of material removal within the natural unit of an entire basin. Basins have linear aspects which can be identified and described, such as stream segments, slope angles, and the like. The relations between these linear measurements influence the amount and rates of erosion and drainage. The areal aspects of basins are described, because the various relations between area and lengths are important in depicting runoff patterns and because this relation is a sensitive and valuable morphometric parameter controlling the texture of landscape dissection and the spacing of streams. Relief aspects of a basin include such features as the longitudinal profile, ground slopes, and distributional characteristics of land elevations. — HRC

08124 **Chorley, R. J.** The role of water in rock disintegration, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 135-155, illus., table, 1969.

A general discussion on the properties of water as a chemical agent, with emphasis upon the bonding characteristics, is followed by a summary of the manner in which water influences weathering. The nature of the silica tetrahedron is important in the weathering of igneous minerals and rocks, as this is a very stable unit and resists the action of the H and O in water; hydrolysis is the major method of attack. The weathering of sedimentary rocks is significant because the material in the rock is it-

self a product of earlier weathering. The nature of cations in the rock is important. Hydration is the chief means of decomposing clay. Weathering can proceed to depths of hundreds of feet, and a mantle of soil is produced. From the practical point of view, the most important aspects of rock weathering are the chemical and physical characteristics of the weathered material. — HRC

08120 **Chorley, Richard J.** (editor). Water, Earth, and Man — A synthesis of hydrology, and socio-economic geography: London, Methuen and Co. Ltd (distributed in USA by Barnes and Noble, New York), 588 p., illus., tables, 1969.

This is an effort to present a unified view of earth and the social sciences with water as the common focal point. This coming together of natural potential and of human need and aspiration provides a unique focus for geographic study. The sections of the book include three papers dealing with worldwide hydrological problems, three dealing with basins, four with precipitation, four on evapotranspiration, three on surface runoff, three on ground water, four on channel flow, four on snow and ice, three on short-term runoff patterns, three on annual runoff characteristics, three on long term trends, and a final paper on choice in water use. Those applicable to geology are cited by individual author. — HRC

08011 **Chou, Chung Chi; McAtee, James L., Jr.** Thermal decomposition of organo-ammonium compounds exchanged onto montmorillonite and hectorite [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 17, no. 6, p. 339-346, illus., 1969.

Thermal effects on these surface modified organic-inorganic complexes were investigated by means of differential thermal analysis and heating-oscillating X-ray diffraction. It was found that the organo-clay complexes were dehydrogenated at temperatures from 180 to 350°C, depending on the organic cation used. Following dehydrogenation, hydrolysis took place leaving a layer of "carbon" on the clay surface. The "carbon" was then oxidized at a temperature of about 550°C. Investigation of possible correlations between activation energy of dehydrogenation and basicity, boiling point, ionization potential, molecular structure, and carbon-carbon bond distances of the organic cations showed that the geometric factors outweighed the acid, chemical and electronic factors in determining the effect of montmorillonite and hectorite toward the dehydrogenation of organic ions exchanged on the surfaces. — *from* Authors' abstract

00244 **Christensen, M. N.; Gilbert, C. M.; Al-Rawi, Y.; Lajoie, K. R.** Late Cenozoic denudation rates in eastern California and northern Chile [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 81, 1970.

Christensen, Robert L. *See* Lipman, Peter W. 00306

00434 **Christiansen, Robert L.; Lipman, Peter W.** Cenozoic volcanism and tectonism in the western United States and adjacent parts of the spreading ocean floor — Pt. 2, Late Cenozoic [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 81-82, 1970.

07781 **Clark, David L.** Paleoecology and sedimentation in part of the Arctic Basin, *in* U. S. Naval Arctic Research Lab. Dedication Symposium, Fairbanks, Alaska, 1969, Proc.: Arctic, v. 22, no. 3, p. 223-245, illus., 1969.

Cores taken from ice-island T-3 in the Canada Basin are being analyzed for magnetic stratigraphy and rates of sedimentation, moisture content, gross mineralogy, carbonate content, texture analysis, and microfauna distribution. The cores show pronounced fluctuations in the abundance of *Globigerina pachyderma* and coarse detritus, although no correlations are yet possible. The presence of sinistrally-coiled *Globigerina* in the upper part of the cores suggests no change in climate in the Arctic for at least 1.5 m.y. There is some correlation between the times of magnetic reversals and faunal change. Magnetic stratigraphy of several cores near the eastern edge of the Canada deep suggests that the entire Pleistocene may be in the core, there is little sediment change in the core save for a color change near the bottom. — HRC

00245 **Clark, Malcolm M.** Some characteristics of the most recently active traces of the Garlock fault [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 82, 1970.

07878 **Clark, Sydney P., Jr.** Heat conductivity in the mantle, *in* The Earth's crust and upper mantle: Am. Geophys. Union Geophys. Mon. 13 (Natl. Acad. Sci.-Natl. Research Council Pub. 1708), p. 622-626, table, 1969.

Of the various possible mechanisms of heat conductivity reviewed, only radiative transfer and mass transport are considered adequate for effecting a substantial increase in thermal conductivity between the surface and depths of 100-200 km. Important amounts of heat will be transferred by mass transport of material if the motion is sufficiently high. — MS

07800 **Cloud, Preston.** Mineral resources from the sea, Chap. [7] *in* Resources and man, a study of recommendations by the Committee on Resources and Man of the Division of Earth Sciences, National Academy of Sciences-National Research Council: San Francisco, Calif., W. H. Freeman and Co., p. 135-155, illus., tables, 1969.

Production values in 1964 are compared from land and sea; all products except seawater extractions are really continental in origin. Elements concentrated in seawater are listed in order of abundance; their eventual recovery needs considerable research. For metals other than magnesium, submarine placers offer the best economic prospects, within an outer depth limit of 100 to 130 m. Continental shelf sediments of post-Paleozoic age, and salt dome structures within them, account for nearly 98 percent of all current mineral production from within and beneath the sea; the greater part is oil and gas, nearly half the fields and one-fourth the production contiguous to the United States. Offshore areas on the Atlantic coast favorable to mineral production are delineated; potential fresh-water resources are mentioned. — GDC

07858 **Cluff, Lloyd S.; Bolt, Bruce A.** Risk from earthquakes in the modern urban environment, with special emphasis on the San Francisco Bay area, *in* Urban environmental geology in the San Francisco Bay region (E. A. Danehy and R. C. Harding, editors): Sacramento, Calif., Assoc. Eng. Geologists, p. 25-64, tables, 1969.

It is important to recognize the interdisciplinary nature of solving the problems associated with earthquake hazards. The solution to many of these problems will be dependent upon the seismologist, geophysicist, geologist, and earthquake engineer to evaluate and delineate the basic causes and effects of earthquakes and communicate this information in practical terms. The result of such work can only be translated into effective action by cooperation of planners, engineers, public officials, and contractors, to reduce life loss and property damage in the next major earthquake. Broad public and governmental support must also exist. — Authors' conclusions.

00246 **Colburn, Ivan P.** The trench concept as a model for central California Cretaceous basin of deposition [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 82-83, 1970.

Cole, Mark R. *See* Yeats, Robert S. 00392

08111 **Colquhoun, D. J.** Coastal Plain terraces in the Carolinas and Georgia [with French abs.], *in* Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, p. 150-162, illus., tables, 1969.

Coastal Plain terrace formations are sediment complexes expressed by landforms of terrestrial and marine origin underlain by terrestrial and marine unconformities. Lithologic, biologic, and environmental facies of these complexes represent Recent Coastal Plain and Continental Shelf environments. In stable areas, thickness depends on river erosion prior to a sea-level rise, depth of marine erosion during such a rise, and thickness of sediments deposited seaward and landward of the shoreline during transgression and regression. A strandline separates the landward sequence of terrestrial origin, from the seaward sequence of marine origin. Stages of these sequences are described. A transgressive-regressive complex is identified by a terrestrial erosional unconformity on a preceding sequence, with a terrestrial or terrestrial and marine sequence overlying. — *from* Author's abstract

07979 **Colson, C. T.** Stratigraphy and production of the Tertiary formations in the Sand Wash and Washakie basins, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 121-128, illus., 1969.

In general, two prerequisites are necessary for commercial Tertiary production in the Sand Wash and Washakie basins. First, favorable structure must be present, with little or no faulting. Second, an advantageous facies must occur over the structural feature. Several structural closures in the area lack production in the Tertiary because of numerous faults or a facies that is not favorable as a host for hydrocarbons. Where a favorable facies for the accumulation of hydrocarbons is present but structural closure is limited or fault-controlled, production is very limited or subcommercial. However, the above two statements are based on wells drilled in these basins of which the vast majority are located on known closures. The possibility of undetected stratigraphic fields occurring in these basins is proposed to the seekers of hydrocarbons. — Author's conclusions

08030 **Conatser, Willis Eugene.** The Grand Isle barrier island complex [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2759B, 1969.

Conoboy, John T. *See* Valentine, James W. 00385

00247 **Conomos, T. John; Broenkow, William W.; Peterson, David H.; Carlson, Paul R.** Seasonal variations in hydrographic properties of the ocean adjacent to San Francisco, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 83, 1970.

Cooper, Alan K. *See* Scholl, David W. 00359

08099 **Cooper, Charles F.** Nutrient output from managed forests, *in* Eutrophication — Causes, consequences, correctives — Symposium [1967], Proc.: Washington, D.C., Natl. Acad. Sci., p. 446-463, tables, 1969.

Temperate and tropical forest drainage has a minimal concentration of nutrient; runoff data may be used to define geochemical provinces. Nutrients enter from weathered rock products, meteorological and biological inputs, and leave by removal of harvested cover, in nitrogen cycle or fire, water transport in solution, and erosion by wind or water. The more important elements of the hydrochemical cycle are summarized, also concentration of major ions in rainwater or dry fallout in selected areas. Circulated at rates and in quantities that differ between atmosphere, pool of soil nutrients, living and dead organic matter, and soil and rock minerals, biological cycling in tropical forests is about 3 times that in temperate zones. Soil has the chief role in simple leakage; steeper storm runoffs, mostly in subsurface flow, feed baseflow of streams in deep soil basins. — GDC

00491 **Cooper, W. A.** Chemical limnology of a developing reservoir (Lake Meredith) in the Texas Panhandle [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 341, 1970.

08135 **Corgan, James X.** Pleistocene marine molluscan faunules from the Little Bahama Bank [abs.]: Tennessee Acad. Sci. Jour., v. 44, no. 2, p. 49, 1969.

07971 **Courdin, James L.; Hubert, John F.** Sedimentology and mineralogical differentiation of sandstones in the Fort Union Formation (Paleocene), Wind River Basin, Wyoming, *in* Symposium on Tertiary rocks of Wyoming—Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 29-37, illus., tables, 1969.

The initial detritus eroded from rising highlands, enclosing the Wind River basin during Paleocene time, consisted of grains from Mesozoic and Paleozoic rocks which mantled the core of the ranges nearby, and consisted largely of quartz, chert, sand-

stone-siltstone fragments, and round grains of zircon, tourmaline, and rutile. Further uplift led to breaching of this mantle, and Precambrian rocks were eroded. The influx of Precambrian detritus was characterized by quartz, feldspar, igneous and metamorphic fragments, and angular zircon, tourmaline, and others. The Precambrian cores of the Washakie, Owl Creek, and northern end of the Wind River Mountains were exposed only locally during the Paleocene. — HRC

Cowan, W. R. *See* Parry, J. T. 07763

Cowles, John. *See* Frey, Robert W. 07944

07769 **Crandall, Clifford J.** Radar mapping in Panama: Photogramm. Eng., v. 35, no. 7, p. 641-646, illus., 1969.

The APQ97 side-looking radar system was used to produce a "radar-mosaic" of a portion of Darien Province in the Republic of Panama, an area which is persistently covered by clouds so as to prevent successful aerial mapping photography. To serve as control points, 5-foot corner reflectors were placed at 13 locations in the 6,000 square-mile area through the use of helicopters. Six flight lines were successfully flown. The data reduction was handled by Raytheon/Autometric. The resulting uncontrolled radar mosaic was used for geologic and hydrologic purposes. — Author's abstract

00248 **Crandell, Dwight R.; Mullineaux, Donal R.; Bath, Gordon D.** Late glacial and postglacial dacitic volcanism near Lassen Peak, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 83-84, 1970.

Crawford, Paul B. *See* Chandler, Ekillis M. 07841

Creager, Joe S. *See* Scholl, David W. 00359

07985 **Crew, Merle E.** Wyoming uranium review, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 169-172, tables, 1969.

From the first announced discovery of commercial uranium deposits in Wyoming in 1951, the industry showed a tremendous growth, attaining a peak production in 1960. The industry maintained faith in the potential of Wyoming during the curtailed production years of the early 1960's and was prompt to renew exploration in the late 1960's when the military requirements were replaced by an increasing demand of the private nuclear power industry. Wyoming is the uncontested leader in the amount of exploration drilling, ranks first in tons of ore in reserves, and if the rate of growth continues, may attain first in annual rate of production of uranium concentrates. — Author's summary

08160 **Cridland, Arthur A.; Darrah, Elsie L.** *Crossotheca urbani* sp. nov., a male fructification from the Pennsylvanian (Desmoinesian Series, Verdigris Formation) of Missouri, U. S. A.: Palaeobotanist, v. 17, no. 1, p. 93-96, illus., 1968 [1969].

Crossotheca urbani Cridland and E. L. Darrah, sp. nov., is described from the Verdigris Formation, from a coal mine dump northwest of Windsor, Henry County, Mo. In general aspects it resembles *C. sagittata* and *C. boulayi*, but the laminate fertile regions of the pinnules are ovoid to oblong. Two rows of corrugated impressions on the pinnules are taken to represent sporangia. Sterile foliage is unknown. The species is known only from the holotype, a specimen preserved in an ironstone nodule, which was studied by a plastic transfer technique. — *from* Authors' abstract

08190 **Cridland, Arthur A.** *Carpannularia* re-examined: Palaeobotanist, v. 17, no. 1, p. 97-100, illus., 1968 [1969].

Carpannularia americana Elias, 1931, collected from Pennsylvanian beds near Clinton, Mo., was originally interpreted as equisetalean shoots, one specimen supposedly bearing seeds. It is here considered a synonym of *Annularia mucronata* Schenk, not

A. stellata (Schlotheim) Wood as interpreted by Abbott (1958). Re-examination of all three cotype specimens immersed in xylene shows seedlike bodies intimately associated with one of the shoots, but no evidence of actual attachment; the densely hairy spatulate leaves are identified with *A. mucronata*, rather than with the glabrous *A. stellata*. — VMJ

Cronin, J. *See* Neal, J. T. 07770

Cronin, J. *See* Gawarecki, S. J. 07771

07980 **Cronoble, James M.** South Baggs-West Side Canal gas field, Carbon County, Wyoming and Moffat County, Colorado, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 129-137, illus., 1969.

The field, on the eastern end of the Cherokee Ridge arch separating the Washakie and Sand Wash basins, and discovered in 1947, now has about 60 wells producing from the Cretaceous Williams Fork, Lewis, Fox Hills, and Lance Formations, and the Tertiary Fort Union Formation. Over 24 MMCF of gas have been produced so far, and ultimate reserves are in excess of 200 MMCF. Events in the structural history of the area are: minor folding during and after Lance deposition, pre-Fort Union erosion, deposition of Fort Union and Wasatch Formations, and uplift accompanied by folding and high-angle vertical faulting. Reservoirs are combination structural and stratigraphic traps. — *from* Author's abstract

Crowder, D. F. *See* Hopson, C. A. 00288

08151 **Crowley, Donald J.** Algal-bank complex in Wyandotte Limestone (Late Pennsylvanian) in eastern Kansas: Kansas Geol. Survey Bull. 198, 52 p., illus., tables, 1969.

The Wyandotte Limestone is divided into seven lithologically and paleontologically distinct facies: *terrigenous* — silty shale and quartz sandstone; *stromatolite-sponge* — biolithite; *algal-bank* — phylloid algal biomicrite, dismicrite, and intrasparrudite; *Archaeolithophyllum cap* — phylloid algal biolithite over algal banks; *calcarenite* — biosparite, intrasparite, and *Osagia* coated biosparrudite; *oolite* — sparite and micrite; and *shelly mud* — crinoidal, brachiopodal biomicrite. Basic factors controlling carbonate facies were geometry and hydrography of the basin of deposition, subsequently modified by changes in water circulation and turbulence. Nature of the substrate, salinity variation, water energy and amount of circulation limited distribution and abundance of the Wyandotte biota. — GDC

08031 **Cullinan, Thomas Anthony.** Contributions to the geology of Washington and St. Tammany parishes, Louisiana [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2759B, 1969.

00249 **Cunningham, G.; Blanchard, M. B.** A method for determining refractive indices of microsize particles [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 84, 1970.

08028 **Currey, Donald Rusk.** Neoglaciation in the mountains of the southwestern United States [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2755B-2756B, 1969.

08088 **Curry, William H., 3d.** Synthetic electric logs in subsurface mapping, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 93-98, illus., 1969.

This paper introduces the concept of subsurface mapping with synthetic electric logs; indicates the nature of the problem of subsurface mapping in the thick, nonmarine Late Cretaceous and early Tertiary basin-fill deposits of Wyoming; summarizes the construction of one type of mechanical accessory log which was designed to emphasize the recognition of subsurface mapping units; and finally, has illustrated the use of this log in the zonation and correlation of the subsurface mapping units in

the Powder River, Wind River, and Red River basins. Details must be added to the broad framework provided by the synthetic logs, however. — *from* Author's conclusions

Curtis, G. H. *See* Turner, D. L. 00382

Cutcliffe, William E. *See* Brown, Severn P. 07818

07991 **Dahill, Murray P.** Third day of field conference — Casper-Orpha-Glenrock-Casper, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 226-232, illus., 1969.

This field trip, 163 miles long and making 6 stops, trends south from Casper to Douglas, and thence northeast to the Badger coal mine and back to Casper. — HRC

07767 **Dalke, George W.; McCoy, Roger M.** Regional slopes with non-stereo radar: Photogramm. Eng., v. 35, no. 5, p. 446-452, illus., table, 1969.

Two monoscopic radar images of the same area of terrain can be used for measurement of regional slopes. By measuring the lengths of individual slopes on each of the images, and knowing the look angle at each point across the images the angle of each slope can be computed. The two pieces of imagery may be taken from opposite sides of an area or both from the same side. Accuracy for individual slopes is fair, but for regional mean slope the accuracy is high. Compensation can be made for apparent slope, and ground range or slant range display systems. — Authors' abstract

08147 **Dallman, John E.** Giant beaver from a post-Woodfordian lake near Madison, Wisconsin: Jour. Mammalogy, v. 50, no. 4, p. 826-830, illus., table, 1969.

Fossil remains of the giant beaver, *Castoroides ohioensis*, are found in the eastern two-thirds of North America, mainly south of the Great Lakes. This is the first occurrence to be reported from Wisconsin. The specimen, represented by a complete cranium with mandible, was found on a mound of marl removed during construction of a fish pond in the old lake bed. Clays in which the skull probably lay were deposited between the retreat of the Woodfordian ice 13,000 yr ago, and the northern advance of the prairie about 8,000 yr ago, coinciding with contraction of the lake. — ESL

07793 **Danehy, Edward A.; Harding, Richard C.** (editors). Urban environmental geology in the San Francisco Bay region: Sacramento, Calif., Assoc. Eng. Geologists, 162 p., illus., tables, 1969.

By 1990, the population in the San Francisco Bay area will be 7.5 million people, and urban areas will suffer the most by intensive land use, lack of water and clean air, and related problems. This symposium of 10 papers describes what geologists can do to help alleviate the problems by identifying water and construction and raw material supply; studies of foundation, mass excavation, and tunneling conditions; landslide and slope stability problems; and especially in the Bay area, the investigation of earthquake hazards. Each paper, dealing with a different aspect of these problems, is cited separately. — HRC

07797 **Danehy, Edward A.** Tunnels of the Bay area, *in* Urban environmental geology in the San Francisco Bay region (E. A. Danehy and R. C. Harding, editors): Sacramento, Calif., Assoc. Eng. Geologists, p. 93-103, illus., table, 1969.

Several urban tunnels in the Bay area are described, including some of the attendant geological aspects. These are: Broadway vehicular tunnel, Stockton Street Railway and Vehicle Tunnel (Pratt Tunnel), Sunset Municipal Railway Tunnel, Twin Peaks Municipal Railway tunnel, Lake Merced Sewer tunnel, and Richmond-Sunset Sewer tunnel. Fifteen tunnels in Alameda County, 14 from Contra Costa County, 7 from Marin County, 2 from Santa Clara County, 23 from San Francisco County, and 16 from San Mateo County are described in a table. Some geological data are included in the tables. — HRC

07799 **Danehy, Edward A.** Geologic data sources, *in* Urban environmental geology in the San Francisco Bay region (E. A. Danehy and R. C. Harding, editors): Sacramento, Calif., Assoc. Eng. Geologists, p. 135-137, 1969.

A discussion of the types of geological information useful to geologists, such as bibliographies, map indexes, etc., and the places where they are to be found in the Bay area, are cited. In particular are government and university libraries and offices in San Francisco, Berkeley, Palo Alto, and Menlo Park. — HRC

07935 **Daniels, R. B.; Gamble, E. E.; Boul, S. W.** Eolian sands associated with Coastal Plain river valleys — Some problems in their age and source: Southeastern Geology, v. 11, no. 2, p. 97-110, illus., 1969.

Eolian sands on the east sides of river valleys in the Neuse drainage basin [North Carolina] have two major source areas. One source is the adjacent flood plain during major periods of deposition of beaches, spits and bars of adjacent estuaries. The second source is the outcrop of coarse sandy sediments on west-facing valley slopes. Eolian sands associated with valley slope source areas can range in age from Pliocene to Recent although one radiocarbon date suggests that some are Recent. — Authors' abstract

00250 **Danner, W. R.** Paleontologic and stratigraphic evidence for and against sea floor spreading and opening and closing oceans in the Pacific Northwest [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 84-85, 1970.

07914 **Dansgaard, W.; Merlivat, L.; Roth, E.** Stable isotope studies on EGIG samples (deuterium and ^{18}O), *in* Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, p. 62-76, illus., tables, 1969.

Results of measurements of the deuterium and O-18 content of numerous snow and ice samples from the central Greenland Icecap are shown in tables. Mean values of all samples from the same location are considered and some general relations evaluated. — EH

Darrah, Elsie L. *See* Cridland, Arthur A. 08160

Davies, J. L. *See* Potter, R. R. 07921

08067 **Davis, Donald R.; Ibert, Edward R.** An ion exchange-filtration-atomic absorption spectrometry technique for the determination of certain trace metals in the water and sediments of the northwest Gulf of Mexico [abs.]: Texas Jour. Sci., v. 20, no. 3, p. 287-288, 1969.

00251 **Davis, L. L.; Lynch, R. D.** Seismic response in Las Vegas, Nevada, from nuclear detonations at the Nevada Test Site [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 85, 1970.

DeFazio, Thomas. *See* Aki, Keiiti. 00219

00468 **Dengo, Gabriel; Levy, Enrique.** Anotaciones al mapa metalogenético de América Central [with English abs.] *in* Mapa metalogenético de América Central, 1:2,000,000; Estudios metalogenéticos de America Céntral: Inst. Centroamericano Inv. y Tecnología Indus. Pubs. Geol., no. 3, p. 1-15, illus., 1970.

The map contains information on type of mineralization, morphology of deposits, geological environment, and age of mineralization where possible. The volume includes a bibliography on mineral deposits of Central America, a list of deposits, and radiometric age determinations with their sources. — MCM

07969 **Denson, N. M.; Pipiringos, G. N.** Stratigraphic implications of heavy-mineral studies of Paleocene and Eocene rocks of Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 9-18, illus., tables, 1969.

Paleocene-Eocene rocks of Wyoming contain two assemblages, largely plutonic in origin, and two largely volcanic. One plutonic has abundant tourmaline and zircon derived from reworked Paleozoic and Mesozoic rocks, and constituted more than 60 percent of nonopaque heavy minerals in Paleocene rocks. The other has abundant first-cycle blue-green hornblende, epidote, and garnet from Precambrian rocks, forming more than 60 percent of nonopaque heavy minerals in lower Eocene rocks. One volcanic nonopaque assemblage in upper Eocene is a green-brown hornblende-augite suite constituting 40 percent or more of nonopaques in the Bridger, Uinta, and Continental Peak Formations. The other is a zircon assemblage constituting 50 percent or more of nonopaque heavy minerals of the Wagon Bed Formation. The hornblende-augite assemblage is from the Absarokas and the zircon from volcanoes in the Rattlesnake Hills area. — *from* Authors' abstract

00252 **Derr, John S.** Surface wave spectra for earthquakes and explosions from the MIT tiltmeter [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 85-86, 1970.

00493 **Dexter, William A.** Teaching earth science through the process of inquiry [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 371-372, 1970.

00454 **Dibblee, T. W., Jr.** Geology of the Transverse Ranges: California Div. Mines and Geology Mineral Inf. Service, v. 23, no. 2, p. 35-37, illus., 1970.

In this region of eastward trends, the rock units may be divided into two main groups, a crystalline basement complex of Precambrian to Jurassic metamorphic and plutonic igneous rocks, exposed mostly in the eastern part, and late Mesozoic and Cenozoic sedimentary and volcanic rocks. Physiographic features are the effect of an enormous amount of north-south crustal shortening by tremendous compressive forces. Part of this shortening is between the marginal Santa Ynez fault and the zone of faults through or adjacent to the Channel Islands and Santa Monica Mountains. These are steep faults transverse to the great San Andreas fault, with movements in part horizontal. The terrane north of the Santa Ynez fault has been pushed westward, and the submerged terrane south of the Channel Islands-Santa Monica fault pushed eastward, relative to the intervening transverse block. — GDC

00253 **Dibblee, Thomas W., Jr.** Stratigraphy of the southern Coast Ranges near the San Andreas fault from Cholame to Maricopa, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 86, 1970.

00254 **Dickinson, William R.** Tectonic setting and sedimentary petrology of the Great Valley sequence [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 86-87, 1970.

Dillinger, William H. *See* Tarr, Arthur C. 07839

08032 **Dimmick, Charles William.** Hinge and early shell development of representative venerid Bivalvia [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2760B, 1969.

07900 **Dobrin, Milton B.** Computer processing of seismic reflections in petroleum exploration, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 41-60, illus., 1969.

Processing of seismic reflection data from digital tape recordings places demands on a computer with regard to speed and storage capacity exceeded in few if any other areas of applications. Once data have gone into the computer input, three primary operations are accomplished: shifting of signals along time scale for corrections (may or may not involve distortion of wave forms); direct composition or addition of signals recorded on different traces with storage of composited signal for further processing or for output; and filtering, involving such steps as autocorrelation, Fourier transform determination, and direct and inverse convolution. The Fast Fourier Transform has increased speed and lowered cost of seismic processing. Computer

output may take the form of digital data converted to analog form and transferred to analog tape for final plotting. Programs have been developed for presenting data on contour maps, time-depth-velocity graphs, and isometric views of subsurface structure. — *from* Author's abstract

00255 **Dodge, F. C. W.; Bateman, P. C.; Wollenberg, H. A.** Compositional variations within intrusive sequences of granitic rocks of the central Sierra Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 87, 1970.

Dodge, F. C. W. *See* Naeser, C. W. 00410

00256 **Dodge, Harry W., Jr.** Klippen of Devonian eastern carbonates on upper Paleozoic clastics in central Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 87-88, 1970.

08140 **Doell, Richard R.; Smith, Peter J.** On the use of magnetic cleaning in paleointensity studies: Jour. Geomagnetism and Geoelectricity, v. 21, no. 3, p. 579-594, illus., tables, 1969.

The use of partial alternating field demagnetization and, to a less extent partial thermal demagnetization, has been found useful as a means of removing secondary components of magnetization from rocks used in certain methods of determining paleointensities. During the course of this investigation, which was carried out on lavas erupted during historic times, it was also learned that a partial remanence characterized by relatively low coercivity possessed blocking temperatures throughout the blocking temperature spectrum. On the other hand, a partial remanence characterized by low blocking temperatures possessed only low coercivity. — Authors' abstract

07932 **Donaldson, J. A.** Descriptive notes (with particular reference to the Late Proterozoic Dubawnt Group) to accompany a geological map of central Thelon Plain, Districts of Keewatin and Mackenzie (65M, N W1/2, 66 B.C.D. 75 P E1/2, 76A E1/2: Canada Geol. Survey Paper 68-49, 4 p., geol. map, 1969.

More than three-quarters of the area mapped is underlain by the Paleohelikian (Late Proterozoic) Dubawnt Group, an assemblage of unmetamorphosed sedimentary and volcanic rocks; elsewhere granitoid rocks and minor amounts of greenstone, quartzite, and schist, form the bedrock. The area is extensively drift-covered; no significant mineralization was noted. [Canada Geol. Survey Prelim. Ser. Map 16-1968 is in pocket.] — *from* Author's abstract

07966 **Donath, Fred A.** The development of kink bands in brittle anisotropic rock, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 453-493, illus., 1969.

Several mechanisms operate in development of kink bands in experimentally deformed brittle, anisotropic rock, such as slate. These are gliding on cleavage accompanied by cataclasis, definition of kink band planes along planes of high shear stress, and rotation of foliation segments between kink planes with slip, cataclasis, and dilation all occurring within the kink band. Straight and parallel kink-band boundaries remained so during continued compression. Rotation of foliation segments within the kink band is effected by slip and continues until orientation is such that slip is no longer possible. Further deformation causes faulting parallel to the band boundaries, the development of secondary slip surfaces, or production of other kink bands. Kink band relations can be used to determine the sense of slip along the anisotropy, the amount of shortening across the band, and the direction of the principal stress axes. Kink-band phenomena may become a useful tool in dynamic structural analysis. — *from* Author's abstract

Dorman, James. *See* Oliver, Jack. 08009

00471 **Dragsted, Ove.** Tugtupite: Jour. Gemmology, v. 12, no. 1, p. 10-11, illus., 1970.

Tugtupite, a new mineral of an intense cyclamen-red color, was described in 1960 from two localities in southern Greenland and the Kola Peninsula by the Russian petrologist, E. I. Semenov, and by the Danish geologist, H. Sörenson. It is a beryllium mineral closely related to sodalite; some details of its properties are given here. After being described as "much rarer than diamond," the local populace visited the research drill holes and broke away the remainder of the material. A minor portion previously sent to Denmark for cutting started a small-scale jewelry production; it is hoped more will come to light with prospecting. Tugtupite was one of the end products crystallized in the Ilímaussaq intrusion in Greenland.—GDC

00425 **Drake, Charles L.** A long-range program of solid-earth studies: EOS, v. 51, no. 2, p. 152-159, 1970.

This article is part of a report of the Ad Hoc Committee on the Long-Range Program of Solid Earth studies, prepared at the request of the IUGG/IUGS to provide a starting point or basic framework for coordinated future efforts in geology and solid earth geophysics. It is proposed that a program of the study of the dynamics of the Earth be divided into four main areas: rheology and physics of the deep interior; dynamics of seismic belts; paleodynamics; and dynamics of more stable areas. The aims of each of these parts of the program, the organization for the program, and its significance are discussed. — DBV

08174 **Dreimanis, Aleksis; Vagners, Uldis J.** Lithologic relation of till to bedrock [with German abs.], *in* Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, p. 93-98, illus., 1969.

The lithologic relationship of till to bedrock was investigated in the Great Lakes Region of North America, chiefly near Hamilton, Ontario, where the Ontario lobe traversed dolostone bedrock for approximately 40 km. In a detailed study of particle sizes in till, the pebble grade was rich in dolostone fragments (usually 70-95 percent) but the dolomite percentage seldom exceeded 50 percent. In the frequency distribution of dolostone and other rock fragments of cobble to clay sizes, the mode of the finer particle sizes became predominant farther away from the source. Till lithology depends upon distance from the source, properties of the source rock, and dynamics of the glacier, including modes of transport and deposition of drift. — *from* Authors' abstract

00418 **Drewes, Harald.** Structural control of geochemical anomalies in the Greaterville mining district, southeast of Tucson, Arizona: U. S. Geol. Survey Bull. 1312-A, p. A1-A49, illus., tables, geol. map, 1970.

Geochemical reconnaissance of the Greaterville mining district in the northern part of the Santa Rita Mountains shows anomalously high concentrations of some base and noble metals. These anomalies are centered around a group of quartz latite porphyry intrusives of late Laramide (Paleocene) age. The ore-forming fluids probably spread from the intrusives along a gently southeastward-dipping thrust fault that underlies a disharmonically folded plate of arkosic rocks. Maximum concentrations of metals may be expected near the stocks and superjacent to the thrust fault. — HD

08183 **Duane, David B.; Meisburger, Edward P.** Geomorphology and sediments of the nearshore continental shelf, Miami to Palm Beach, Florida: U. S. Army Corps Engineers Coastal Eng. Research Center Tech. Memo. 29, [114] p., illus., tables, 1969.

This part of the continental margin of southeastern Florida was surveyed for sand deposits potentially usable for shore protection and beach restoration. Data from between 15- and 100-ft depths consisted of seismic reflection profiles and sediment cores of the sea floor and shallow subbottom strata. South of Boca Raton to Miami, much of the shelf is rocky with a thin sediment veneer and locally thick trough sediments, almost entirely sand-size calcareous skeletal fragments with a total volume of 201 million cu yd. North to Palm Beach, the shelf is overlain by a thick blanket of homogeneous fine-to-medium, gray sand, half quartz particles and half calcareous skeletal fragments of more than 380 million cu yd, but too fine to be ideally suited for

use on local beaches. In terms of potential beach sand, the sand size sediment from this shelf is of marginal quality. — *from* Authors' abstract

07983 **Duell, Garth A.** Pacific Power and Light's coal operations, Converse County, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 155-160, 1969.

The Dave Johnston coal field is in the southwestern portion of the Powder River basin; the coal beds dip gently toward the northeast at about a 4 percent grade. The coal beds are locally called the School and Badger seams and are located at or near the top of the Tongue River Member of the Paleocene Fort Union Formation. The upper seam, the Badger, marks the base of the Eocene Wasatch Formation; the School seam is 180 feet below. The Badger seam averages 17-20 feet thick, and the School seam 35 feet. The beds are essentially undeformed. The reserves in the field are estimated at 115 million tons with an overburden of less than 3 yards per ton of coal. — HRC

08029 **Duffett, Walter Nelson.** Arroyo-shoreline relationships in northwest Baja California, Mexico [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2756B, 1969.

00257 **Duffield, Wendell A.; Sharp, Robert V.** Stratigraphy and structure of pre-Tertiary rocks between the Melones and Bear Mountains fault zones, Amador County, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 88, 1970.

00439 **Duncan, John R.; Fowler, Gerald A.; Kulm, L. D.** Planktonic foraminiferan-radiolarian ratios and Holocene-late Pleistocene deep sea stratigraphy off Oregon: Geol. Soc. America Bull., v. 81, no. 2, p. 561-566, illus., 1970.

The ratio of planktonic foraminiferans to radiolarians has proven to be an effective and easily determined parameter for the establishment of deep-sea faunal stratigraphy in the northeastern Pacific off Oregon and Washington. The Pleistocene-Holocene boundary, dated at 12,500 years B.P., is marked by a change from a dominance of planktonic foraminiferans below to a dominance of radiolarians above. Three less-well-defined intervals of increased radiolarian abundance occurred from 16,000 to 18,000, 25,000 to 28,000, and greater than 31,000 or 30,000 years B.P. These suggest slight warming periods during the late Pleistocene — Author's abstract

07981 **Dunnewald, John B.** Big Piney LaBarge Tertiary oil and gas field, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 139-143, illus., 1969.

The field is in the west central part of the Green River basin in Sublette and Lincoln counties on a large structural high known as the LaBarge platform. A number of anticlinal folds with associated high-angle reverse and tear faults, upthrown to the east, are present. Folding occurred prior to Tertiary deposition as well as after. Production is from several sand formations in the Mesozoic Nuggett to Paleocene Fort Union Formations. Most is from the Fort Union under many different conditions, such as: eastward deflections of sand pinchouts on monoclinal dips, sand pinchouts crossing anticline noses, up-dip faulting of sand pinchouts, actual structural closure, and in isolated sand bodies in the Mesozoic rocks. — HRC

00485 **Dupré, William R.; Boyer, Robert E.** Orbital photography over Texas and northern Mexico — Some geologic applications [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 334-335, 1970.

08128 **Dury, G. H.** Hydraulic geometry, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 319-329, illus., tables, 1969.

Hydraulic geometry is the graphical analysis of the hydraulic characteristics of a stream channel; these include width, depth, slope, discharge, velocity, bed material, and load. Discharge can be regarded as the only fully independent variable. Bed material is an independent variable insofar as its properties are determined by outcropping bedrock in the floor or sides of the channel, and also since its properties are controlled by the geology of the catchment area. Loose material however, will be sorted during transit, and will also undergo reduction of size and change of shape. The remaining characteristics interact upon one another in a complex fashion. The whole series is considered by groups, and the frequency-characteristics of discharge are introduced at an early juncture. — *from* Author's introduction

08130 **Dury, G. H.** Relation of morphometry to runoff frequency, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 419-430, illus., 1969.

Some generalizations regarding stream morphometry are given. Channel pattern is examined, especially with regard to the difference between habit and pattern, with considerable discussion regarding meanders, their origin, growth, and attributes. The development of pools and riffles are discussed to illustrate that a uniform bed-slope is unstable just as development of meanders shows that a straight stream trace is unstable. Braiding is a product of mobile streambeds so that any phenomenon which promotes widening and associated shallowing of the channel will promote braiding. Floodplains are described, and the differences between channel-side accretion and overbank deposition are emphasized. Meandering valleys with meandering streams within them are considered underfit; the origin of such features is discussed. — HRC

08172 **Dzerdzeyevskiy, B. L.** Climatic epochs in the twentieth century and some comments on the analysis of past climates [with German abs.], *in* Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, p. 49-60, illus., 1969.

For the reconstruction of past climates the synchronization of tree-ring measurements and pollen samples, obtained from isolated and usually distant points, is very important. However, the analysis of climatic data and dynamic processes and their relationships with other geographic components is of even greater importance. Some results of such investigations are discussed in this paper. The existence of two climatic epochs in the twentieth century is described. A meridional circulation prevailed during the first epoch, and a zonal one during the second. The beginning of a third epoch in the 1950's is confirmed. The change of temperature and precipitation and noticeable reaction of the vegetation to these climatic fluctuations was observed. — Author's abstract

Eaton, J. P. *See* Lee, W. H. K. 00304

Eaton, J. P. *See* Stewart, S. W. 00372

Eaton, Jerry P. *See* Unger, John D. 00384

07950 **Edmondson, W. T.** Eutrophication in North America, *in* Eutrophication — Causes, consequences, correctives — Symposium [1967], Proc.: Washington, D.C., Natl. Acad. Sci., p. 124-149, illus., tables, 1969.

In spreading across this continent people encountered a variety of lakes in different environments, and in each area initially different stages of productive conditions, on which the effect of human activity had differing impact. Natural eutrophication, and that induced by agricultural drainage and waste disposal, have been variously approached with regard to scientific investigation and practical control measures; most outstanding in study of artificially enriched lakes may be the development of nutrient budgets. Cited are limnological case historiesof nuisances in regions of formerly clear lakes in New England and Wisconsin, and big reservoir lakes near Seattle, Wash. The concentrations at which nutrients are delivered to lakes and the interaction of nutrients must still be considered. Some degree of amelioration is possible but expensive; increasing public awareness and better techniques may lead to considerable improvement in deteriorated lakes. — GDC

00258 **Ehrreich, Albert L.; Winchell, Robert E.** Diopside and andradite in amygdules in an ignimbrite [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 88-89, 1970.

00259 **Ehrreich, Albert L.; Winchell, Robert E.** Rapakivi texture in rhyolite [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 89, 1970.

08106 **Eisenlohr, Williams S., Jr.** The water budget of a prairie pothole [with French abs.], *in* Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, p. 61-64, table, 1969.

Thousands of prairie potholes, shallow, generally elliptical depressions less than half a square kilometer in area, are found on the glaciated prairies of the north-central United States. A table shows the water budget by months for a typical pothole for one year. Water from precipitation and runoff is held in the potholes for at least a month. There is ground-water inflow only in limited areas. The outflow-seepage rate is very low, and seasonal evapotranspiration is about equal from all ponds, many of which have emergent vegetation. The water budgets reflect a climate having no great fluctuations since recession of the glaciers. A wetter climate would have produced more numerous drainage channels, a drier one aqueous and eolian deposits in the potholes. — *from* Author's abstract

00412 **Elsasser, Walter M.** The so-called folded mountains: Jour. Geophys. Research, v. 75, no. 8, p. 1615-1618, illus., 1970.

We show that the usual model in which folded mountain chains are assumed to originate by lateral compression does not constitute a unique explanation. An alternative model, here only developed qualitatively, is proposed in which undulations of originally horizontal strata are produced by lumps of crustal material that rise from below and attach themselves to the bottom of continental plates. This model corresponds to the orogenic process that can be observed when basaltic material is molten, and then rises at a Gutenberg seismic fault zone that slopes down toward a continent. — Author's abstract

00260 **Engdahl, Eric R.; Flinn, Edward A.; Romney, Carl F.** Inner core reflections [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 89-90, 1970.

Engels, J. C. *See* Naeser, C. W. 00410

08101 **Erickson, J. Mark.** Geological rate units: Compass, v. 47, no. 1, p. 5-9, illus., tables, 1969.

Geologists are urged to adopt Fischer's recently (1969) proposed Bubnoff unit (B) as the standard geologic time-distance rate unit (B = one micron per year = 1 mm per 1,000 years) for all geological rates. In order to hasten acceptance of B in the geologic vocabulary, a table of values for conversion of English notation into B units is given herein. Future applications of B, such as construction of isobubnoff contour maps, should be recognized. Finally, since rate situations which employ very large distance components, or very short time components, are important, the Megabubnoff (MB) and microbubnoff (μB) units are here proposed to make notation more flexible under such circumstances. The Megabubnoff unit, MB, has a value of 1×10^6 B, and the microbubnoff unit, μ B, is 1×1000^{-3} B. It is urged that these rate units be employed in all discussion of geological rates for the betterment of scientific communication. — Author's abstract

00261 **Ernst, G. W.** Do Diablo Range mineral parageneses reflect high-pressure conditions of Franciscan recrystallization? [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 90, 1970.

00262 **Estavillo, William; Rogers, Mark.** Potassium-argon dating of metamorphic and plutonic igneous rocks from San Matias Pass, Baja California, Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 90-91, 1970.

07844 **Ethridge, Frank G.** The problem of distinguishing sedimentary environments with grain-size distributions [abs.]: Texas Jour. Sci., v. 20, no. 3, p. 288, 1969.

08014 **Evans, Howard E.** Three new Cretaceous aculeate wasps (Hymenoptera): Psyche, v. 76, no. 3, p. 251-261, illus., 1969.

It has seemed probable that Aculeata underwent a radiation in the Cretaceous, and recently three wasps have been studied that indicate that they became quite diversified before the end of the Mesozoic. Three diverse stocks of aculeates, sphecids, bethyloids, and ants, were present in the Cretaceous. New genera described are *Archisphex*, *Lisponema*, and *Procleptes*. The new species, *A. crowsoni*, comes from England. *L. singularis* and *P. carpenteri* were found in amber from Cedar Lake, Manitoba. It was surprising to find such specialized wasps in the Cretaceous. — ESL

08129 **Evans, Ian S.** The geomorphology and morphometry of glacial and nival areas, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 369-380, illus., 1969.

Glacial and nival hydrology is particularly sensitive to temperature and to radiation, and hence latitude, altitude, and aspect are particularly important influences on glacial and nival land landforms. Slope direction and relative position on slopes is also important in mountain areas and can complicate zonation. Slope gradient and aspect affect the surface receipt of precipitation and radiation, and this leads to asymmetry of nival balance and of temperature. This probably explains the general mid-latitude tendency for glaciers and cirques to face preferentially northeastward. Wind drifting from smooth summits and plateau areas produces snow accumulation on lee slopes, and in the west-wind belt this encourages east-facing glaciers and cirques. However, on rugged terrain, the snow is trapped on west-facing slopes, and radiation becomes an important factor. — HRC

08015 **Fairchild, W. W.; Wesendunk, P. R.; Weaver, D. W.** Eocene and Oligocene Foraminifera from the Santa Cruz Mountains, California: California Univ. Pubs. Geol. Sci., v. 81, 144 p., illus., 1969.

Foraminifera of more than 300 named and unnamed species and varieties (none new) of 75 genera are described and figured, and their distribution plotted, from scattered areas of the Santa Cruz Mountains north of Boulder Creek, Calif. These areas lie within a Tertiary marine trough, the Santa Cruz embayment, southwest of the San Andreas Fault Zone, where the Paleocene to Pliocene sequence is thickened and structurally complex. The rich foraminiferal faunas of the Butano, San Lorenzo, Vaqueros, and Lambert formations in these areas are evaluated chronologically by reference to faunas of two continuous sequences of the type San Lorenzo and Soquel Creek sections described by F. R. Sullivan (1962) and R. K. Smith (1968). The middle Eocene to uppermost Oligocene faunas represent the Ulatisian, Narizian, Refugian, Zemorrian, and Saucesian stages. — VMJ

Falk, Michael. *See* Seidl, V. 08010

07852 **Fenstermaker, Charles D.** Resumé of current activity of the oil industry northeast of the Mississippi River, geographic, geologic, and magnitude of recent years' discoveries, *in* Kentucky Oil and Gas Assoc., 32d Ann. Mtg., 1968, Proc. Tech. Sess.: Kentucky Geol. Survey Spec. Pub. 17, p. 50-77, illus., 1969.

Recent exploration activity in the northeastern United States covers: Illinois Basin, additional St. Louis discovery and development, Trenton and deeper exploration; development of Pennsylvanian and Upper Mississippian production in Camp Breckinridge; Cincinnati Arch, expanding development from Sulphur Lick Field; south-central Kentucky and north-central Tennessee from Lower Mississippian through Upper Ordovician pays; Urbana Field of Indiana; Michigan Basin, Devonian (Dundee) and Silurian discoveries, including Niagaran reefs; Appalachian Basin, developments in Ohio, eastern Kentucky along Rockcastle River Uplift, Boyd County Rome sandstone well has produced Middle Cambrian oil; several areas in West Virginia, where Newburg sandstone is the chief producer. Areas of future exploration are also given. — *from* Author's abstract

Finney, J. J. *See* Ito, Tei-ichi. 08081

00263 **Firby, James R.** Relationship of tectonic and climatic events to the evolution of aquatic nonmarine mollusca in the western Great Basin [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 91, 1970.

Firby, James R. *See* Slemmons, David B. 00363

00264 **Fischer, Joseph F.** Fluid inclusions, uralitization and grain size, Carbon River stock, Washington [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 91-92, 1970.

Fisher, Donald W. *See* Rodgers, John. 07812

Fisher, Donald W. *See* Park, Richard A. 07816

00440 **Fleming, George; Poodle, Thomas.** Particle size of river sediments: Am. Soc. Civil Engineers Proc., v. 96, paper 7068, Jour. Hydraulics Div., no. HY 2, p. 431-439, illus., 1970.

The relationships between particle size of river sediments and the variation in stream discharge are studied. The results of a study carried out to determine the variation of both bed material and suspended sediment particle size for differing flow conditions are presented. A significant finding is presented which shows that the particle size of suspended and bed sediments remains relatively constant with variation in stream discharge. This condition was found from the analysis of results at four river sections on three rivers in Scotland and was also corroborated by results from research in the United States. Conclusions are presented which attempt to explain these findings in terms of the availability of material for transport by streams rather than on purely hydraulic considerations. — Authors' abstract

Flinn, Edward A. *See* Engdahl, Eric R. 00260

08021 **Flory, Donald Andrew.** Stable carbon isotope ratio measurement of meteoritic carbonaceous material [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2570B-2571B, 1969.

00265 **Follwill, Fred E.; Nuttli, Otto W.** Shear body wave travel times and velocity distribution in the lower mantle [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 92, 1970.

07856 **Ford, Robert S.** Ground water geology of Livermore Valley — A satellite urban area, *in* Urban environmental geology in the San Francisco Bay region (E. A. Danehy and R. C. Harding, editors): Sacramento, Calif., Assoc. Eng. Geologists, p. 125-133, illus., 1969.

A description of the ground-water bearing rocks and the structures in Livermore Valley are given. The Jurassic Franciscan Group underlies the southern part of the valley and is nonwater-bearing. Various Tertiary rocks and alluvial materials contain water in varying amounts; water-bearing alluvial fans and terrace deposits are also common. Six major and five local faults present in the region have displaced aquifers and created barriers of various sorts, resulting in an irregular distribution of the ground water. Connate water and meteoric water are both present and their distribution is important in ground-water recovery. — HRC

07901 **Forgotson, James M., Jr.; Stout, John L.** Future of well-data information systems, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 61-72, illus., tables, 1969.

Well-data files, initially for assembling historical information on wells drilled for petroleum exploration and exploitation, now include current data to provide a base for decision making and technical study of exploration progress and results. Efficient file maintenance and data retrieval demand file organization that is standard between geographic areas and compatible between all peripheral files. A present data file,

containing information on approximately 600,000 wells drilled in the United States, has the basic items necessary for a competitive exploration program; provision is made for addition of material. Each well has a controlled latitude and longitude for posting results on maps. —*from* Authors' abstract

08114 **Foster, John D.; Palmquist, Robert C.** Glacial landforms of the Ames area, *in* The many faces of geology — Tri-State [Geol.] Field Conf., 33d, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, p. 28-39, illus., 1969.

This paper describes some of the surficial features of the glacial topography of the Ames, Iowa, area. Based on the relief and on the tone and texture of aerial photographs, the topography is classified as nonlineated and lineated, the latter including parallel and transverse ridges, glacial drainageways and kames. Parallel ridges, which are predominant in the area, consist chiefly of sandy clay-till, whose characteristic fabric is indicative of a lodgement till or ground morainal deposit. It is concluded that the topographic lineaments were either formed during active flow or during ice-stagnation as controlled ice-disintegration features. The origin of the till suggests a subglacial, lodgement origin for the ridges. Areas previously mapped as end moraine should be ground moraine. — EH

07830 **Fountain, David M.** Seismicity movie of the circum-Pacific belt large magnitude events, 1897-1964 [abs.]: Earthquake Notes, v. 40, no. 4, p. 11, 1969.

Fowler, Gerald A. *See* Duncan, John R. 00439

07863 **Franzmeier, D. P.; Pedersen, E. J.; Longwell, T. J.; Byrne, J. G.; Losche, C. K.** Properties of some soils in the Cumberland Plateau as related to slope aspect and position: Soil Sci. Soc. America Proc., v. 33, no. 5, p. 755-761, illus., tables, 1969.

Soils developed from acid siltstones and shales were sampled on the steep north and south-facing slopes in transects made across ridges in eastern Kentucky and Tennessee. Particle size distribution, base saturation, and soil temperature are related to slope position. Soils in middle slopes are higher in coarse material than those in upper or lower positions. Soils in lower slope positions have the highest base status and are coolest. Slope aspect influences soil temperature and organic matter content and the kinds of horizons formed and their color. Most soils on south-facing slopes have argillic horizons while most on north-facing slopes have cambic horizons. Soils on north slopes have almost 2°C lower mean annual temperature, contain more organic matter, are darker in color, and hold more water during a period of water stress than soils on south slopes. — Authors' abstract

00465 **Freers, Theodore F.** Geology and ground water resources, Williams County, North Dakota — Pt. 1, Geology: North Dakota Geol. Survey Bull. 48, pt. 1 (North Dakota Water Comm. County Ground Water Study 9), 55 p., illus., table, geol. map, 1970.

Near the center of the Williston basin, preglacial formations up to 14,828 feet thick dip south except along flanks of the N-S striking Nesson anticline. Nearly all of the area is covered, except along the Missouri River, by late Wisconsin till and outwash, on uplands ranging from a few to over 100 feet thick. Oldest exposed rocks are patches of Tertiary formations and Pleistocene preglacial Wiota Gravel; thick silt, sand and gravel fill has buried the preglacial Yellowstone and Little Missouri River valleys, their northflowing courses diverted eastward by the glaciers. Two ice advances are recognized. The most important mineral resource is petroleum, mainly from the Madison Formation along the Nesson anticline; currently mined are sand, gravel, lignite, "scoria," and salt. — GDC

08089 **Frey, David G.** Evidence for eutrophication from remains of organisms in sediments, *in* Eutrophication — Causes, consequences, correctives — Symposium [1967], Proc.: Washington, D.C., Natl. Acad. Sci., p. 594-613, illus., 1969.

The paleolimnologist working with a static sedimentary record of the dynamic system can return to any part of it, but his information is much less than that available to the limnologist; many processes and organisms leave no traces. In many cases of cultural

eutrophication, documentation of the lake in precultural times is missing. The advantage of biochemical substances produced by organisms or in their degradation is that only a small quantity of sediment is needed for analysis. Morphological fragments can be identified with producing organisms, but must be abundant enough for construction of very short stratigraphic intervals, at most in centimeters. Pollen and spores, diatom frustules, and Cladocera fragments are most important in fresh water ecosystems; other groups cannot be overlooked. Community analysis is the best approach to ecologic changes; the degree to which diatoms dissolve is significant. — GDC

07944 **Frey, Robert W.; Cowles, John.** New observations on *Tisoa*, a trace fossil from the Lincoln Creek Formation (mid-Tertiary) of Washington: Compass, v. 47, no. 1, p. 10-22, illus., 1969.

The trace fossil *Tisoa* Serres, unreported previously from the United States, has been found at a locality in the Lincoln Creek Formation (mid-Tertiary) of Washington. Specimens consist typically of two closely appressed, cylindrical tubes that constitute the long axis of conical or cylindrical calcareous concretions. Diagenetic minerals, particularly pyrite, are concentrated along most tube walls; unaltered walls commonly bear small longitudinal striations. Rare specimens show that tubes may branch and that the two parallel tubes constituting most specimens are actually the upper part of a single, U-shaped tube. Tisoans consisting of a single straight tube were also found. *Tisoa* represents a dwelling burrow, probably made by an arthropod. — Authors' abstract

07940 **Frimpter, Michael H.** Casing detector and self-potential logger: Ground Water, v. 7, no. 6, p. 24-27, illus., 1969.

A simple and rapid method of determining casing length and permeable zones in wells tapping bedrock can be useful to well drillers and hydrologists. A device consisting of a galvanometer, a reel of insulated wire, and a copper electrode locates the casing depth, changes of lithology, and permeable zones. The small-diameter electrode permits measurement through well-seal access ports avoiding the expensive and time-consuming procedure of removing the seal and drop pipes to measure casing depth with a magnet. The measured electromotive force changes rapidly when the electrode passes the end of casing. Thus, the depth of casing is easily determined from the length of wire played out. Changes in electromotive force measured within the uncased part of a well frequently indicate permeable zones, thereby aiding in choice of the most efficient drop-pipe length, and also yielding useful information for hydrogeologic studies. — Author's abstract

08042 **Fritts, Paul Jan.** Some Late Cretaceous coccoliths of Colorado and eastern Wyoming [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2830B, 1969.

00414 **Fritz, T. C.; Thurston, R. N.** Extrapolation formula for finding the volume of solids at high pressures: Jour. Geophys. Research, v. 75, no. 8, p. 1557-1569, illus., 1970.

A formula is proposed for extrapolating from data taken at low or moderate pressures to the high pressures existing in the interior of the Earth and planets. When $m = K_o'$ (K_o' = first pressure derivative of bulk modulus K at zero pressure, m = value of first pressure derivative in the limit K approaches infinity), the formula reduces to the Murnaghan relation. To apply the new formula, K_o' is determined from low-pressure ultrasonic data, m is fixed at some reasonable value, and the remaining parameter is determined by trial and error to fit available high-pressure data. Rough estimates of the initial value of the second pressure derivative of K can be obtained in this way. As examples, the formula is fitted to published experimental data on aluminum oxide, α-quartz, Mg, K, Na, and Pb. — DBV

Gamble, E. E. *See* Daniels, R. B. 07935

08133 **Ganster, Maurice; Stearns, Richard G.** Configuration and source of anomalous magnetic field near Gordonsville in Smith County, Tennessee [abs.]: Tennessee Acad. Sci. Jour., v. 44, no. 2, p. 49, 1969.

Garcia, John. *See* Sommer, Michael A. 00366

07929 **Garlick, G. Donald.** Consequences of chemical equilibrium across phase changes in the mantle: Lithos, v. 2, no. 4, p. 325-331, illus., 1969.

Abrupt changes in mean atomic weight within the transition region of the mantle, as indicated by recent geophysical observations, may be a consequence of chemical equilibrium across phase transitions involving solid solutions. Equilibrium across the phase transitions may result from metasomatism by migrating interstitial fluids or by direct crystallization from a magma. [Phase transitions constitute the underlying cause of chemical inhomogeneities.] — Author's abstract

Gast, P. W. *See* Kay, R. 00411

00266 **Gastil, Gordon; Krummenacher, Daniel.** Reconnaissance potassium-argon dates for Cenozoic volcanic rocks in the State of Baja California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 92-93, 1970.

Gastil, Gordon. *See* Krummenacher, Daniel. 00299

Gaucher, E. *See* Salamis, C. 07924

Gauman, A. J. *See* Simmonds, P. G. 08056

07771 **Gawarecki, S. J.; Neal, J. T.; Cronin, J.; Williams, R. S., Jr.** Geologic information from satellite infrared imagery, *in* Satellite imagery of the Earth: Photogramm. Eng., v. 35, no. 7, p. 661-664, 1969.

Presently available infrared imagery was acquired from Nimbus I and II satellites. The high-resolution system was able to detect volcanic activity. The basalt eruption on Surtsey volcano in Oct. 1966 was detected as well as a complex pattern of anomalies outside the eruption area, principally due to fumaroles and fissures. Other features recognized on available imagery include distribution of ice and major lineaments. Future possibilities with improved ground and thermal resolution in the far infrared spectrum are discussed. — ESL

07882 **Gees, Rudolf A.** Sampling of laminated beach sands: Maritime Sediments, v. 5, no. 2, p. 40-43, illus., 1969.

Layered beach sands may be sampled across the layers, producing so-called channel samples, and by stratified random sampling, for subpopulations from one stratification only. Macrolaminae are the thinnest units practical for sampling in the field. The framed device described here, 200 × 40 × 15 cm, was built to investigate feasibility of obtaining large samples from specific laminae. Used on two beaches in California, it was too large and impractical, but showed the difficulty in stratified sampling of beach sands. The stratification of aeolian sands, more regular and consistent, lends itself more readily to such sampling. A much smaller device, 12 × 4 × 3 in, is presently used for sampling beach sands in a selective manner. Shallow ditches are first dug into the foreshore slope until a site is found where lamination is "regular." — GDC

08012 **Gees, Rudolf A.** The age of the Bermuda Sea Mount: Maritime Sediments, v. 5, no. 2, p. 56-57, illus., 1969.

Two basalt samples of the Bermuda Platform were dated by the K-Ar method: one, from a churn-drilled well (depth 714-716 feet) west of Gibb's Hill lighthouse in Southampton Parish, as 34.4 (±3.0) m.y.; the other, from a corehole (depth interval 140-145 feet) near Ferry Reach causeway over Castle Harbor, as 52.4 (±2.5) m.y. To date the samples have not been investigated geochemically or petrologically, so these ages should be regarded as somewhat temporary. No definite criteria to judge the validity of K-Ar ages of submarine basalts have been established, so caution is urged in applying K-Ar dates to deep-ocean basalts. No information pertaining to water depth under which the Bermuda basalts erupted is available, but tentative emplacement can be correlated to about middle Eocene to middle Oligocene. — GDC

00267 **Geldsetzer, Helmut.** Late Cenozoic volcanic cycles in the Pacific Northwest and their tectonic implications [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 93, 1970.

Gelpi, E. *See* Simmonds, P. G. 08056

08167 **Gerassimovsky, V. I.; Stupnikova, N. I.; Zykov, S. I.** On the age of the Ilímaussaq and Igaliko intrusions in the Gardar province of southern Greenland [with Danish abs.]: Dansk Geol. Foren. Medd., v. 19, no. 2, p. 224-226, table, 1969.

A sample of well crystallized zircon from a pegmatite at Narssârssuk near Igaliko, South Greenland, has been dated by uranium-lead methods. Although the sample has suffered loss of uranium, a probable age of 1150 ± 120 m.y. has been calculated. Lead from a galena sample from a hydrothermal vein at Kvanefjeld near Narssaq is shown to be anomalous, owing to the polycyclic nature of the rocks of South Greenland — Authors'abstract

07867 **Gernant, Robert Everett.** Paleoecology of the Miocene Choptank Formation of Maryland and Virginia [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 5, p. 2331B, 1969.

08181 **Gershanovich, D. Ye.** Osnovnyye cherty geomorfologii dna Beringova morya i zaliva Alyaska [Main features of the geomorphology of the bottom of the Bering Sea and Gulf of Alaska]: Problemy Arktiki i Antarktiki, no. 31, p. 53-60, illus., 1969.

The submarine topography and morphostructures of the Bering Sea and Gulf of Alaska are described. A line extending southwestward from the head of the Gulf of Alaska separates two types of transition between continent and ocean. West of that line the transition proceeds through a marginal sea basin separated from the ocean floor by the island arc and deep-sea trench; east of it, the continental shelf and its foot grade directly into the ocean floor. Near the head of the Gulf there is also a change in strike of the main structures on land. — DBV

07869 **Gertman, Richard L.** Cenozoic Typhinae (Mollusca: Gastropoda) of the western Atlantic region: Tulane Studies Geology and Paleontology, v. 7, no. 4, p. 143-191, illus., 1969.

This study of the muricid subfamily Typhinae shows that, of the 26 genus-group names originally proposed, 4 genera and 17 subgenera are valid, with about 125 species. Of these, the 3 genera, 9 subgenera, and 36 species known from the Cenozoic of the western Atlantic region are treated systematically herein, including 10 new species: *Typhis* (*Typhina*) *palmerae*, middle Eocene, Texas; *T.* (*T.*) *mississippiensis*, lower Oligocene, Mississippi; *T.* (*Talityphis*) *carmenae*, upper Miocene, Veracruz, Mexico; *T.* (*Rugotyphis*) *keenae*, *T.* (*Typhinellus*) *chipolanus*, *Pterotyphis* (*P.*) *calhounensis*, *P.* (*Tripterotyphis*) *vokesae*, all lower Miocene, Florida; *Siphonochelus* (*Pilsbrytyphis*) *dariensis*, *S.* (*P.*) *woodringi*, both middle Miocene, Panama; *S.* (*Laevityphis*) *bullisi*, Pleistocene, Costa Rica, and living in Caribbean. — VMJ

Gettrust, J. *See* Lewis, B. R. T. 00305

Ghisler, M. *See* Herd, R. K. 08161

08022 **Gibson, Everett Kay, Jr.** Inert carrier-gas fusion determination of total nitrogen abundances in stony and iron meteorites [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2574B, 1969.

00268 **Gibson, R. E.; Moody, M. L.; Ayre, R. S.** Free vibration of an unsymmetrical multistoried building modeled as a shear-flexible cantilever beam [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 93-94, 1970.

00269 **Gibson, R. E.; Moody, M. L.; Ayre, R. S.** A response spectrum solution for earthquake analysis of unsymmetrical multi-storied buildings [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 94, 1970.

Gilbert, C. M. *See* Christensen, M. N. 00244

00270 **Gilbert, Wyatt G.** Structural relations along the Sur fault [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 94-95, 1970.

08060 **Gile, L. H.; Grossman, R. B.; Hawley, J. W.** Effects of landscape dissection on soils near University Park, New Mexico: Soil Sci., v. 108, no. 4, p. 273-282, illus., tables, 1969.

The major differences in soils of the desert area near University Park, New Mexico, have been caused by differences in age, climate, and degree of landscape dissection. Fresh arroyo sediments show no evidence of soil development. Entisols are of late Holocene age and have weak carbonate horizons. Aridisols are of late Pleistocene age; some have argillic horizons and all have K horizons. The soils occur in complex patterns related to variable degrees of landscape dissection and associated soil truncation. With increasing landscape dissection, the soil moisture regime becomes more arid due to greater runoff. — *from* Authors' summary

00271 **Gisler, Patrick; Lange, Nixon; Barnett, George.** Genesis of mordenite in the Aravaipa member, Galiuro Volcanics, Pinal County, Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 95, 1970.

Givens, W. W. *See* Caldwell, R. L. 07998

08079 **Glaeser, J. Douglas.** Geology of flagstones in the Endless Mountains region, northern Pennsylvania: Pennsylvania Geol. Survey, 4th ser., Inf. Circ. 66, 14 p., illus., 1969.

Flagstone is a mineral commodity in the Endless Mountains region that has been growing in use for both domestic and industrial construction. This report on the physical properties, regional distribution, occurrence and origin of flagstones in northern Pennsylvania is prepared especially for individuals without geologic training who are interested in discovery and development of these sandstone deposits. Four qualitative factors that can be used as guides are; parallel stratification, relatively uniform grain size, restricted range in sand-size fragments, and color indicating mineral resistance to weathering. Quarry operators take advantage of vertical jointing in the nearly flat beds of alternating sandstone and shale. Crossbeds, not uniform in thickness, are of limited value. Reserves seem to be unlimited in this area. — GDC

08066 **Glawe, Lloyd N.** *Pecten perplanus* stock (Oligocene) of the southeastern United States: Alabama Geol. Survey Bull. 91, 179 p., illus., tables, 1969.

Taxonomy of Vicksburgian pectens of the *P. perplanus* evolutionary stock is here considered on the basis of biological species concept (interbreeding population). More than 2500 valves were collected in 84 samples from 19 composite sections along a 400-mile outcrop belt from Rosefield, La., to Marianna, Fla. Taxonomic significance of shell characters was statistically determined from associations of their determined stratigraphic, lithologic, and geographic distribution. Two biological species and five subspecies are distinguished, each characterized by dominance of one morphotype, recognizable by right-valve external sculpture: *P. perplanus*, with subspecies *perplanus*, *poulsoni*, *byronensis*; *P. howei*, with subspecies *howei*, *mariannensis* n. subsp. Lectotypes and a neotype are designated. — VMJ

07916 **Goldberg, E.** Lead-210 in glaciers, *in* Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, p. 88-92, illus., table, 1969.

Investigations were made, using lead-210, to establish the geochronology of the formation of ice-sheets. Samples of glacial meltwater from one location on the Greenland Icecap were processed for their lead-210 content. Results showed a general decrease of the lead-210 activity with depth. — EH

07796 **Goldman, Harold B.** Raw material resources of the San Francisco Bay region, *in* Urban environmental geology in the San Francisco Bay region (E. A. Danehy and R. C. Harding, editors): Sacramento, Calif., Assoc. Eng. Geologists, p. 83-92, illus., 1969.

Abundant reserves of construction materials, such as sand and gravel, are concentrated in stream deposits near Livermore. Stone quarries ring the Bay area, and common brick is manufactured in three different counties. Expandible shale for lightweight aggregate is also present, and oyster shells and mud dredged from the Bay and limestone deposits near Permanente are used to manufacture cement. Mercury is abundant in many of the Bay area counties, and salts are obtained by the evaporation of sea water. Conflicts in land use and the loss and future need for mineral lands can best be resolved through cooperation between planners, civic officials, mineral producers, and the general public.—*from* Author's abstract

00272 **Goodspeed, G. E.** Fluidization of the viborgite rapakivi in the Salmon River Mountains, Idaho [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 95-96, 1970.

07946 **Graf, W. H.; Acaroglu, E. R.** A reply to comments on "Sediment transport in conveyance systems" [by K. C. Wilson, 1969]: Internat. Assoc. Sci. Hydrology Bull., v. 14, no. 4, p. 134-135, 1969.

Graf and Acaroglu [ibid., v. 13, nos. 2 and 3, 1968] sought to propose a relation which can be used for both open surface and closed conduit flow. [For discussion *see* ibid., p. 131-134.] — VSN

Granath, J. W. *See* Langenheim, R. L., Jr. 00303

00273 **Grannell, Roswitha B.** Geological and gravimetric studies of Franciscan serpentinite bodies in the southern Santa Lucia Range, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 96, 1970.

Grant, D. R. *See* Prest, V. K. 08168

00274 **Greeley, Ronald; Hyde, Jack H.** Lava tubes of Mount St. Helens, Washington [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 96-97, 1970.

08071 **Green, Trevor H.** The diopside-kyanite join at high pressures and temperatures: Lithos, v. 2, no. 4, p. 333-341, illus., table, 1969.

Initial mixes of composition (molecular proportions) 2 anorthite:2 enstatite:diopside have been crystallized at 1200° C over a pressure range of 13.5-36 kb. The stable mineral assemblage changes from anorthite + clinopyroxene solid solution + orthopyroxene at 13.5 kb to clinopyroxene solid solution + garnet + minor quartz at 18 kb to clinopyroxene solid solution + garnet + minor quartz + minor kyanite at 22.5-36 kb. The proportion of garnet and its grossular content increases with increasing pressure. Upon addition of 0.5, 1, and 2 moles of jadeite to the initial mix, crystallization of garnet is markedly inhibited and grossular content decreases. This study has application to the relative stability of clinopyroxene-kyanite or garnet-quartz assemblages in natural rocks such as eclogites and grospydites from kimberlite pipes. — Author's abstract

00275 **Greene, H. Gary.** Microrelief of an Arctic beach [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 97, 1970.

00276 **Greene, Robert C.** A crystal-rich ash-flow tuff in southeast Oregon [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 97-98, 1970.

07928 **Greeson, Phillip E.** Lake eutrophication, a natural process: Water Resources Bull., v. 5, no. 4, p. 16-30, illus., tables, 1969.

Lake eutrophication is an economic, recreational, and aesthetic problem that affects every lake of the world. Eutrophication is the natural process of lake aging, and progresses irrespective of man's activities. Pollution, however, can hasten the natural rate of aging and shorten the life expectancy of a body of water. The eutrophication of a lake consists of the gradual progression from one life stage to another based on the degree of nourishment or productivity. The extinction of a lake is attributed to enrichment by nutritive materials, biological productivity, decay, and sedimentation.

Presently used methods for retarding eutrophication are the abatement of cultural enrichment, treatment of eutrophic symptoms, and control of fundamental causes. — Author's abstract

07902 **Griffiths, J. C.; Ondrick, C. W.** Modelling the petrology of detrital sediments, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 73-97, illus., tables, 1969.

Main factors that lead to variation in detrital sediments are conceptually labelled as source material, which may consist of fresh rock and its weathered products, erosion, transportation, deposition, and diagenesis; interpretive petrology depends upon specification of petrographic properties which reflect variation arising from these sources. If measured properties are related to factors in a two-dimensional classification the resulting model supplies a basis for expectations and a tool for deciding what properties to measure. Examination of properties which appear to be most informative, and an attempt to segregate operational meaning of these measurements, suggest that careful use of redundance may lead to improvements in channel capacity and increase signal-to-noise ratio, leading to reduction of theoretical concepts to operationally identifiable components and a clarification of relations between properties and components. — *from Authors' abstract*

00277 **Griggs, Gary B.** Possible Holocene climatic fluctuations [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 98, 1970.

00487 **Groat, Charles G.** Effects of ground water on geomorphology, Lower Mojave Valley, California [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 336, 1970.

Gross, M. Grant. *See* Ladd, Harry S. 07894

07874 **Gross, Walter.** Friedrich Freiherr von Huene, 22.2.1876-4.4.1969: Paläont. Zeitschr., v. 43, nos. 3-4, p. 111-112, 1969.

Grossman, R. B. *See* Gile, L. H. 08060

08017 **Gupta, G. C.; Malik, W. U.** Chloritization of montmorillonite by its coprecipitation with magnesium hydroxide [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 17, no. 6, p. 331-338, illus., tables, 1969.

A magnesium hydroxide-montmorillonite complex prepared at OH/Mg molar ratio of 2(16 meq Mg/g clay) and immediately cleaned of any free $Mg(OH)_2$ behaves like magnesium-chlorite and shows no change during 3 months aging. Magnesium hydroxide completely precipitates within the interlayer space of montmorillonite. Analyses and measurements confirm the transformation of montmorillonite to a chlorite-like structure. Further aging of the complex results in release of brucite from the interlayer space and expansion of the complex on glycerol treatment. X-ray analysis of the 6-months aged sample shows the presence of free brucite but not montmorillonite. When the $Mg(OH)_2$ montmorillonite complex is aged in presence of free $Mg(OH)_2$ in a dry state, a "seeding" effect takes place and the "fixed" $Mg(OH)_2$ starts coming out from the interlayer space after 10 days. — *from* Authors' abstract

08041 **Haji-Vassilou, Andreas.** The association of uranium with naturally occurring organic materials in the Colorado Plateau and other areas [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2829B, 1969.

Hall, C. A. *See* Turner, D. L. 00383

Hall, Clarence. *See* Surdam, Ronald C. 00376

08150 **Hamblin, W. Kenneth.** Marine paleocurrent directions in limestones of the Kansas City Group (Upper Pennsylvanian) in eastern Kansas: Kansas Geol. Survey Bull. 194, pt. 2, 25 p., illus., 1969.

Crossbedding directions in limestones of the Kansas City Group have a bimodal distribution on both a local and regional scale. In each unit the primary mode is to the southwest, whereas the secondary mode is in the opposite direction. The strike of megaripples in these deposits is normal to these trends. Crossbedding in associated sandstones, in contrast, is unimodal, with the average direction trending to the southwest in Kansas, west and northwest near the Oklahoma-Kansas state line, and northward in south-central Oklahoma. These data indicate that marine paleocurrent systems during deposition of limestones of the Kansas City Group moved back and forth perpendicular to the shore and were probably the result of ebb and flow of tides. — Author's abstract

00464 **Hanna, G. Dallas.** Fossil diatoms from the Pribilof Islands, Bering Sea, Alaska: California Acad. Sci. Proc., v. 37, no. 5, p. 167-233, illus., 1970.

Diatoms collected by Hanna and others since 1913 are recorded and figured. The fossils are from Pliocene beds exposed at several localities on St. Paul and St. George islands and from drill-hole samples from recorded depths in the 400 feet deep Navy water well no. 2 on St. Paul. The diatoms are not comparable to living forms, but are similar to those recorded by Jouse (1959), Zabelina (1934) and other Russian authors from the Pliocene of Kamchatka and Sakhalin. Mollusks from the Pribilof beds were considered Pliocene by W. H. Dall (1899, 1919). Fifty-six diatom species of 27 genera are described briefly, including three new species, *Biddulphia baltzoi*, *Cocconeis pribilofensis*, *Xanthiopyxis lohmani*; also three species of Silicoflagellata, including *Mesocena coronata* n. sp., and one of Ebriata. — VMJ

Hanna, W. F. *See* Oliver, H. W. 00328

00447 **Hansen, Dan E.; Kume, Jack.** Geology and ground water resources of Grand Forks County — Pt. 1, Geology: North Dakota Geol. Survey Bull. 53, pt. 1 (North Dakota Water Comm. County Ground Water Study 13), 76 p., illus., tables, geol. maps, 1970.

This county is underlain by westward-dipping Paleozoic and Mesozoic sedimentary rocks and Precambrian igneous and metamorphic rocks, shown in a stratigraphic column and described briefly. The covering glacial drift, with a maximum thickness of 455 feet, can be differentiated into 5 sheets, each separated into lithic units. Bedrock surface relief is much greater than that on present glacial topography. The western part is covered mainly by ground moraine, stratified drift in kames, eskers, and disintegration ridges and outwash plains; to the east is the Agassiz lake plain with only a few ridges and scarps, and 9 strandlines in multiple beach ridges. Saline soils cover shallow subcropping Dakota sandstones to the north. Mineral resources include sands and gravels of beach ridges, ground water from outwash and delta plain aquifers, and some marlstones, bentonitic clays, and limestones. — GDC

08059 **Hansen, Richard O.; Huntington, Gordon L.** Thorium movements in morainal soils of the High Sierra, California: Soil Sci., v. 108, no. 4, p. 257-265, illus., tables, 1969.

Thorium distributions in a sequence of morainal soils in Bench Valley, Calif., were determined by gamma-ray spectrometry of profile samples. Concentrations of thorium ranged from 10.8 ppm in a B2h horizon to 24.0 ppm in a B2ir horizon. The A2 or B2ir horizons, respectively, contained higher thorium concentrations when overlain by Al or B2h horizons. The thorium concentrations became complex when associated with organic matter or iron but were not affected appreciably by change in pH. — JWH

Harding, Richard C. *See* Danehy, Edward A. 07793

07795 **Harding, Richard C.** Landslides — A continuing problem for bay area development, *in* Urban environmental geology in the San Francisco Bay region (E. A. Danehy and R. C. Harding, editors): Sacramento, Calif., Assoc. Eng. Geologists, p. 65-74, illus., 1969.

Engineering geologic maps, outlining existing and potential landslide areas, can be prepared for regions of future development. In addition, these maps could show

earthquake faults, areas of building-foundation problems, valuable mineral and building material deposits, areas suitable for landfill projects, and valuable surface and ground water resources. From these maps the best utilization of the resources could be made, as well as planning of defenses against hazards. Numerous photographs are included as demonstrations of the effects of landslides. — HRC

08004 **Hardy, H. Reginald, Jr.** Recent studies of the mechanical behavior of geologic materials using ultrasonic and microseismic techniques: Earthquake Notes, v. 40, no. 4, p. 29-50, illus., tables, 1969.

The mechanisms responsible for deformation and failure in geologic materials under conditions favoring brittle behavior are difficult to investigate by direct means. Indirect methods utilizing ultrasonic and microseismic phenomena, however, appear to be applicable. This paper reviews the results of a number of recent experiments carried out on specimens of Barre Granite, Indiana Limestone and Tennessee Sandstone. These include the investigation of a phenomenon termed "Initial Failure" using ultrasonic velocity and attenuation data, and the study of inelastic deformation and failure using microseismic techniques. The experimental results are compared with the behavior predicted by assuming that these materials consist of an elastic media containing pre-existing or potential crack distributions. — Author's abstract

00278 **Hardyman, Richard F.** Subsolidus reequilibration and secondary alteration of a primary sulfide assemblage in the basal Duluth Gabbro Complex, Minnesota [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 98-99, 1970.

07990 **Harston, L. W.; Heisey, E. L.** Second day of field conference — Casper-Shirley Basin-Casper Mountain-Casper, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 220-225, illus., 1969.

This field trip, 134 miles long and making 8 stops, begins in Casper, goes southward to the Petrotomics Mine and Mill and vicinity, and returns to Casper. Geological observations en route are included; stops visit several different mineral deposits in the region. — HRC

00279 **Hart, Gary C.** Linear oscillator response to segmented nonstationary ground motions [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 99, 1970.

Hart, Gary C. *See* Saragoni, Rudolfo. 00355

00477 **Hart, S. R.; Nalwalk, A. J.** K, Rb, Cs and Sr relationships in submarine basalts from the Puerto Rico trench: Geochim. et Cosmochim. Acta, v. 34, no. 2, p. 145-155, illus., tables, 1970.

Basalts dredged from a restricted region on the north wall of the Puerto Rico trench show a wide range in K (620-5600 ppm), K/Rb (430-2030), K/Cs (4560/81,000) and K/Sr (6.8 - 35.7). There is a positive correlation between K, K/Rb, K/Cs, K/Sr, Sr and SiO_2. Deuteric or sea water alteration of these basalts is suggested by high H_2O contents and Fe_2O_3/FeO ratios. If Sr-87/Sr-86 ratios as high as 0.706 are taken as evidence of sea water alteration then it follows that such alteration processes may produce the observed positive trends of K/Rb and K/Cs versus K content. The extreme freshness required for meaningful trace-element analysis of K-Ar dating of submarine basalts is emphasized by these results. — Authors' abstract

07936 **Hatcher, Robert D., Jr.** Structure of the Dumplin Valley fault zone in east Tennessee: Southeastern Geology, v. 11, no. 2, p. 85-96, illus., 1969.

The fault zone is a complex of branching splay thrusts that developed in a superficial hanging wall anticline where the underlying sole in the area changes level. It extends from Morristown to Etowah, a distance of about 90 miles. Involved in faulting are some 10,000 feet of sedimentary rocks, ranging in age from Early Cambrian to Middle Ordovician. Two large thrusts and their branches are traceable through most of the mapped area, and are interconnected only at one place. Toward the southwest,

the southeasternmost fault overrides the northwest one, and at the southwest end of the mapped area faulting diminishes and branches of the remaining fault terminate in tight folds. At the northeast end of the structure, stratigraphic displacement diminishes and two large anticlinal folds are the most prominent features. Structure of the footwall is synclinal. — *from* Author's abstract

Hawkins, James W. *See* Winterer, Edward L. 07996

00280 **Hawkins, James W., Jr.; Allison, Edwin C.** Volcanic petrology and paleontology of Northeast Bank, southern California borderland [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 99-100, 1970.

Hawley, J. W. *See* Gile, L. H. 08060

Hays, W. W. *See* Murphy, J. R. 00321

00281 **Hays, Walter W.** The effect of Yucca fault on seismic wave propagation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 100, 1970.

08050 **Heezen, Bruce C.; Johnson, G. Leonard.** Alaskan submarine cables — A struggle with a harsh environment [with French and Russian abs.]: Arctic, v. 22, no. 4, p. 413-424, illus., table, 1969.

The Alaskan cable system at one time included 86 submarine telegraph cables stretching from Puget Sound northward through the Alaskan Panhandle and thence westward into the Aleutian Island Arc. Cable failures in this system reveal dynamic natural forces affecting the sea floor. The cable failures can primarily be attributed in straits on the continental shelf and upper continental slope to chafe by bottom currents, and off the mouths of major streams to turbidity currents and gravitational slides. — Authors' abstract

Heginbottom, J. A. *See* Parry, J. T. 07763

Heisey, E. L. *See* Harston, L. W. 07990

00282 **Helley, Edward J.; Ritter, John R.** Fluvial sediment load calculations and their significance to erosion rates with special application to north coastal California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 100-101, 1970.

08074 **Henderson, G.** The Precambrian rocks of the Egedesminde-Christianshaab area, West Greenland: Grönlands Geol. Undersögelse Rap. 23, 37 p., illus., geol. map, 1969.

Most of the area described consists of quartzo-feldspathic gneisses with zones and bands of mica schist and pelitic gneiss, amphibolite, and a few thin marble and calc-silicate bands. Granitic rocks are also present, but of minor importance. A large quartz diorite body is thought to represent a folded and metamorphosed intrusive sheet. Two metamorphic complexes are present, a predominantly amphibolite facies complex and a granulite facies complex. Migmatites are a prominent feature in some areas of mica schist and pelitic gneiss. At least two, and probably three, deformation phases are presented. A good correlation has been established with adjoining areas. — Author's abstract

08163 **Henoch, W. E. S.** Topographic maps of Canada in glaciological research [with French, German and Spanish abs.]: Canadian Cartographer, v. 6, no. 2, p. 118-129, illus., 1969.

The author reviews topographic maps published by Canadian federal and provincial government agencies in their role as research tools for the specialist in glaciological research. The demand for precise and systematic symoblization of ice features on topographic maps is emphasized by the current requirement to complete a World Inventory of Perennial Ice sponsored by the International Hydrological Decade (1965). The inadequacies of topographic maps in portraying ice features are detailed

by the author, and certain recommendations for their improvement are discussed. It is suggested that orthophoto mapping would be well-suited to delineate ice formation, and that topographic maps should show the distribution of perennial snow and ice using a carefully selected symbolization, and be plotted from late-summer air photography. — Author's abstract

08087 **Henriksen, Niels.** Chemical relations between metabasaltic lavas and metadolerites in the Ivigtut area, south-west Greenland [with Danish summ.]: Dansk Geol. Foren. Medd., v. 19, no. 1, p. 27-50, illus., tables, 1969; *reprinted as* Grönlands Geol. Undersögelse Misc. Paper 66, 1969.

Chemical analyses of representative samples from a swarm of metadolerite dikes penetrating the pre-Ketilidian basement in the Ivigtut area indicate that the earlier sets of dikes have tholeiitic compositions and that the latest dikes (set no. 4) are more alkaline. Analyses of rocks representing different metamorphic facies conditions in the same dike indicate Ketilidian metamorphic reactivation of the basement under isochemical conditions in the northern Ivigtut area. It is concluded that the metadolerites and Ketilidian metavolcanics cannot have been derived at the same time from the same source, as they have slightly different chemical compositions. The dikes are considered pre-Ketilidian. —*from* Author's abstract

08161 **Herd, R. K.; Windley, B. F.; Ghisler, M.** The mode of occurrence and petrogenesis of the sapphirine-bearing and associated rocks of West Greenland: Grönlands Geol. Undersögelse Rap. 24, 44 p., illus., tables, 1969.

Described in detail are 7 occurrences of sapphirine-bearing rocks in the Fiskenaesset region, within a chromite-layered anorthosite complex metamorphosed first by a hornblende-granulite facies and then by a cordierite-amphibolite facies. They were derived from spinel-layered ultramafic lenses along contacts between major meta-anorthosite and pyribolite/amphibolite horizons. Enstatite, pargasite, gedrite and phlogopite types bearing sapphirine represent a petrogenetic sequence in metasomatism related to shearing and deformation along contacts. Their relation to nonsapphirine-bearing rocks is described, also two occurrences in the Sukkertoppen region, localized in meta-norite-ultramafic lenses in high grade gneisses. It is concluded that sapphirine is stable within a wide range of P-T conditions, but limited range of chemical environment. Mineral assemblages and properties of the major rock-forming minerals are tabulated (in pocket). — GDC

Hershey, Robert E. *See* Wilcox, J. T. 08136

00283 **Hibbard, M. J.** Magmatic origin of Lower Cretaceous granitic gneisses and migmatites, Okanogan Range, Washington [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 101, 1970.

07984 **Hicks, Merle E.; Woodward, Thomas C.** Project Thunderbird, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 161-163, illus., 1969.

This is a progress report on a proposed nuclear explosion to obtain gas from coal in northeastern Wyoming. Five major coal beds are present, the shallowest about 1,000 feet deep, the deepest about 2,200 feet; most average 50 feet thick but vary up to 150 feet. Over 22,000 million tons are estimated in reserve. Fourteen holes have been drilled to outline the bodies and to obtain samples for analyses. Project Thunderbird is serving as a site for research work aimed at extracting the immense energy from coal, one of the proposals being a nuclear blast. The resulting gas would be upgraded at the surface. — HRC

08110 **Higgins, Charles G.** Isostatic effects of sea-level changes [with French abs.], *in* Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, p. 141-145, 1969.

Rates of isostatic adjustment estimated for continental sites suggest adjustments are attained slowly; thus, isostatic responses of continental shelves would be expected to

lag far behind sea-level changes that initiated them. Postglacial isostatic sinking of most coastal areas would tend to mask eustatic fluctuations caused by late-Pleistocene glacial fluctuations, so that these coasts appear to record a continuous rise of postglacial sea level. Many marine shelves may still be subsiding under the added water load, which would help to explain widespread submergence of coastal sites within the past 2,000 years; little change in relative sea level has been observed at coasts where isostatic adjustment may be either slow or nearly completed. The history of Quaternary eustatic fluctuations cannot be deciphered from local records of relative sea-level changes until hydroisostatic components are evaluated. — *from* Author's abstract

00284 **Hill, David P.** Crustal structure of the Columbia Plateau from the Edzoe events [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 101-102, 1970.

08001 **Himmelberg, G. R.; Loney, R. A.** Mineralogy and petrology of the alpine-type peridotite at Burro Mountain, California [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 101, 1969.

00285 **Himmelberg, Glen R.; Loney, R. A.** Origin and emplacement of the alpine type peridotites of the California Coast Ranges [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 102, 1970.

00286 **Hofmann, R. B.; Anderson, D. L.; Tocher, Don; Ryall, Alan; Morrill, B. J.** Cooperative seismic data exchange in California and Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 102-103, 1970.

00287 **Hollenbaugh, Kenneth M.** Geology of a portion of the north flank of the San Bernardino Mountains, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 103, 1970.

Holmes, Mark L. *See* Scholl, David W. 00359

07862 **Holtz, Wesley G.** Soil as an engineering material: U.S. Bur. Reclamation Rept. 17 (Water Resources Tech. Pub.), 45 p., illus., tables, 1969.

This lecture was published previously in Jour. Materials, v. 4[!3], no. 4, p. 847-915, 1968. *See* Abstracts of North American Geology, June 1969. — ESL

07888 **Hood, J. W.; Waddell, K. M.** Hydrologic reconnaissance of Deep Creek Valley, Tooele and Juab Counties, Utah, and Elko and White Pine Counties, Nevada: Utah Dept. Nat. Resources Tech. Pub. 24, 54 p., illus., tables, 1969.

The known ground-water reservoir in Deep Creek valley, in unconsolidated Tertiary and Quaternary rocks, underlies at least 32,000 acres. The source of water is an estimated 290-1000 acre-feet of average annual precipitation, nearly half of which falls on the lowlands of the drainage basin, below an altitude of about 6,500 feet, and does little more than sustain soil moisture. Estimated average annual recharge to and discharge from the ground-water reservoir is 17,000 acre-feet. Amount of ground water available for salvage from nonbeneficial discharge is estimated at about 4,000 acre-feet. Water is suitable for domestic, stock, and irrigation purposes. Because existing stream and spring supplies appear to be fully appropriated, future additional development would have to depend on water from wells. — *from* Authors' abstract

07893 **Hood, J. W.; Price, Don; Waddell, K. M.** Hydrologic reconnaissance of Rush Valley, Tooele County, Utah: Utah Dept. Nat. Resources Tech. Pub. 23, 63 p., illus., tables, 1969.

The source of all water in Rush Valley is the 550,000 acre-feet of precipitation that falls mainly on the Oquirrh, Stansbury, Onaqui, and Sheeprock Mts.; no surface water leaves the topographically closed valley. Estimated average annual ground-water recharge to and discharge from Rush Valley is in the range of 34,000-37,000 acre-feet; ground water is discharged from the valley by wells, by evapotranspiration, and by subsurface outflow through the east edge of the valley. Chemical quality of

water is generally good for irrigation and domestic purposes. Ground water is the main source of water for future development. Because the valley is among the more densely populated of the desert basins in western Utah and because of increasing interest in the area, a detailed water-resources study is needed. — *from* Authors' abstract

07952 **Hooper, Frank F.** Eutrophication indices and their relation to other indices of ecosystem change, *in* Eutrophication — Causes, consequences, correctives — Symposium [1967], Proc.: Washington, D.C., Natl. Acad. Sci., p. 225-235, 1969.

A good eutrophication index should adequately document past changes, in a common language for biologists, ecologists, and engineers in discussion of problems, to scale the rate of change and anticipate detrimental events. Four criteria are: ability to differentiate between changes in enrichment level and seasonal effects as well as changes associated with short-term climatic cycles; sensitivity to levels of enrichment; properties like an index fossil, widespread geographically and short-lived geologically; suitability for long-term surveillance and monitoring by many generations of scientists. Eutrophic indices utilized or proposed are oxygen budgets, water transparency, morphometry of environment, concentration of nutrients and associated ions, biological species, productivity, diversity and stability. All discussed here measure processes occurring at all stages of enrichment. — GDC

07853 **Hopkins, John T., Jr.** Cartographic activities of the geologic mapping program in Kentucky, *in* Kentucky Oil and Gas Assoc., 32d Ann. Mtg., 1968, Proc. Tech. Sess.: Kentucky Geol. Survey Spec. Pub. 17, p. 78-82, illus., 1969.

The Kentucky Areal Geologic Mapping Program conducted cooperatively by the State and Federal governments through the Kentucky Geological Survey and the U. S. Geological Survey has prepared and published some 300 large-scale geologic quadrangle maps in the past 8 years. The planned completion of the program during the next several years will provide complete geologic map coverage of the State at 1:24,000 scale. The assignment of a geologic cartographer with a small cartographic work force to the U. S. Geological Survey project headquarters in Lexington, Ky., has proved most effective. Cartographic personnel working closely with the field geologists proceed with format design and map finishing almost immediately upon completion of field studies. Proofing and editing are completed and coordinated with the Kentucky Geological Survey at Lexington before maps are shipped to the U. S. Geological Survey Reproduction Plant in Washington, D. C. — Author's abstract

07824 **Hopkins, William S., Jr.** Palynology of the Eocene Kitsilano Formation, southwest British Columbia: Canadian Jour. Botany, v. 47, no. 7, p. 1101-1131, illus., table, 1969.

Approximately 55 genera and 75 species of plant microfossils are illustrated and described from the Kitsilano Formation of southwestern British Columbia. The general composition of the flora suggests a humid, warm temperate climate prevailed at time of deposition. Previous work on plant megafossils indicates a late Eocene to possibly early Oligocene age. Plant microfossils recovered in this study support a probable middle to late Eocene age for the Kitsilano Formation. — Author's abstract

00288 **Hopson, C. A.; Cater, F. W.; Crowder, D. F.** Emplacement of plutons, Cascade Mountains, Washington [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 104, 1970.

08152 **Horvath, Allan L.** Relationships of Middle Silurian strata in Ohio and West Virginia: Ohio Jour. Sci., v. 69, no. 6, p. 321-342, illus., tables, 1969.

The Estill, Bisher, Lilley, and Peebles Formations crop out in Adams and Highland Counties, Ohio, and can be traced several miles east into the subsurface of the Appalachian Basin. Farther east, the Peebles and Lilley strata lose their distinctive lithology and become part of the Lockport beds, which intertongue with carbonates of the McKenzie in eastern Ohio and western West Virginia. The drillers' Clinton Shale shows a three-fold division in central Ohio, and the upper and middle units can

be traced southwestward into the Bisher, and the lower, into the Estill Shale of southern Ohio. To the east, near the Ohio-West Virginia boundary, the middle Clinton unit shows a facies relationship with the Keefer Sandstone. The lower unit can be traced eastward into the upper half of the Rose Hill in West Virginia. — *from* Author's abstract

00450 **Hesman, R. L.; Broussard, W. L.; Calandro, J. J.** Water resources of northwestern St. Landry Parish and vicinity, Louisiana: Louisiana Geol. Survey and Dept. Public Works Water Resources Pamph. 23, 29 p., illus., tables, 1970.

Water of good chemical quality is available from both surface- and ground-water sources in northwestern St. Landry Parish area. The Chicot-Atchafalaya aquifer which blankets the entire area and is capable of sustaining high well yields, is 150 to 300 feet thick and contains fresh water throughout the area; the water, characteristically hard and high in iron content, requires treatment for many uses. The Evangeline aquifer, which underlies the Chico-Atchafalaya contains fresh water only in the extreme western section where the water is a sodium bicarbonate type, soft, and generally low in iron. — *from* Authors' abstract

Houser, F. N. *See* Sargent, K. A. 00356

Howard, Robert B. *See* Orme, Antony R. 00330

07834 **Howell, B. F., Jr.** Coriolis force and the new global tectonics [abs.]: Earthquake Notes, v. 40, no. 4, p. 15, 1969.

Hubbard, N. J. *See* Kay, R. 00411

07854 **Hubbert, M. King.** Energy resources, [Chap.] 8 *in* Resources and man, a study and recommendations by the Committee on Resources and Man of the Division of Earth Sciences, National Academy of Sciences-National Research Council: San Francisco, Calif., W. H. Freeman and Co., p. 157-242, illus., tables, 1969.

Coal supplies may last 2 or 3 centuries more and oil and gas only about 80 or 90 years at current rate of usage. Power production directly from solar energy is technologically unpromising, water and wind power are limited, and geothermal and tidal power now being exploited promise no more than a fraction of requirements. This leaves nuclear energy as the only source of sufficient magnitude and practicability of exploitation to meet needs. The various resources are reviewed, comparing estimates for the United States and world supply, and production curves by components, including oil shale and tar sands. Energy potential from various reactors is considered, along with disposal of wastes. — GDC

Hubert, John F. *See* Courdin, James L. 07971

Hubley, Myron D. *See* Barrett, William J. 07978

Hudson, D. E. *See* Trifunac, M. D. 00380

00289 **Huffman, O. Frank.** Miocene and post Miocene offset on the San Andreas fault in central California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 104-105, 1970.

07913 **Hughes, B.; Peiker, P.; Schumacher, E.** Elektrolytische anreicherung des tritiums der Grönland-Eisproben, *in* Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, p. 42-54, illus., tables, 1969.

The author describes electrolytic methods of concentrating tritium in water samples from the Greenland Icecap, in order to measure the very small tritium activity of most samples. — EH

07780 **Hunkins, Kenneth.** Arctic geophysics, *in* U. S. Naval Arctic Research Lab. Dedication Symposium, Fairbanks, Alaska, 1969, Proc.: Arctic, v. 22, no. 3, p. 225-232, illus., 1969.

A summary is given of the geophysical activities in the ocean basin. Various types of readings are constantly being made, and those dealing with bathymetry and basin configuration are developed more strongly. Outlines of the major physiographic provinces are illustrated. Three major ridge systems cross the basin with their axes nearly parallel, and each of the ridges has its own characteristics. The Alpha Cordillera is broadly arched in profile; the Lomonosov Ridge contrasts with this in shape, texture, and magnetic field. Both are aseismic, whereas the Arctic Mid-Ocean Ridge, an extension of the Mid-Atlantic Ridge, is seismically active and appears to be a center of spreading. Crustal structures in the Arctic Ocean await studies of the Lomonosov Ridge as a possible piece of continental shelf and the Alpha Cordillera as a locus of ancient spreading. — HRC

Huntington, Gordon L. *See* Hansen, Richard O. 08059

07949 **Hutchinson, G. E.** Eutrophication, past and present, *in* Eutrophication — Causes, consequences, correctives — Symposium [1967], Proc.: Washington, D.C., Natl. Acad. Sci., p. 17-26, 1969.

When Weber in 1907 introduced, in German, terms — eutrophic, mesotrophic, and oligotrophic — to describe nutrient conditions determined by chemical nature of soil solution in peat bogs, the succession proceeded in that order as a raised bog was built up. Applied in limnology in 1919, these terms referred to water types characterized in theory by content of nutrients, but in practice by ability to support poor or rich communities of phytoplankton. With proliferating terms, this concept faced problems, such as no evidence of phosphorus loss as algal populations were maintained. Renewed studies recognized rapid cyclic changes in nutrient elements between sediments and free water. It is now apparent that lakes and their drainage basins and sediments form reversable oligotrophic or eutrophic systems; the total available supply of nutrients in all forms, and the rate at which it circulates are important factors. — GDC

07792 **Huxel, C. J., Jr.** Water resources and development in Mason Valley, Lyon and Mineral Counties, Nevada, 1948-65, *with a section on* surface water *by* E. E. Harris: Nevada Div. Water Resources, Water Resources Bull. 38, 77 p., illus., tables, geol. map, 1969.

The Mason Valley floor is underlain by a thick sequence of alluvium and fan deposits that forms the principal source of ground water. The alluvium contains abundant, well-sorted sands and gravel with transmissibilities of from 50,000-200,000 gpd per foot and specific yields of about 20 percent. Total water stored in the uppermost 50 feet of saturation is about 1 million acre-feet. Annual figures are given for inflow, precipitation, consumption, outflow and evapotranspiration. Most stream and ground water is of suitable quality for agricultural, domestic and mining use. Specific conductances are generally less than 1,000 micromhos. About 100,000 acre-feet per year of ground and surface water might be developed by decreasing evapotranspiration losses and surface water outflow and by increasing ground water pumping. — *from* Author's abstract

Hyde, Jack H. *See* Greeley, Ronald. 00274

07791 **Iacopi, Robert.** Earthquake country (revised edition): Menlo Park, Calif., Lane Books, 160 p., illus., 1969; originally published 1964.

This revised, condensed, paperback version of the 1964 edition on California earthquakes does not contain all of the illustrations of the original publication, but will serve as material for the layman or the scientific worker looking for information outside his own field. The three main headings of the various sections are: why California has earthquakes, traveling along California's faults, and prospects for the future. There is an index, but no bibliography. — MCM

Ibert, Edward R. *See* Davis, Donald R. 08067

Idriss, I. M. *See* Kovacs, W. D. 00298

Ingram, R. L. *See* Pickett, T. E. 07937

00473 **Iranpanah, Assad.** Trace-element analyses of the Ada shales and sandstones, Seminole and Pontotoc Counties, Oklahoma: Oklahoma Geology Notes, v. 30, no. 1, p. 5-10, illus., table, 1970.

A semiquantitative emission spectrographic analysis of 28 selected samples was performed to determine the geologic history of the Ada Formation. Boron, copper, nickel, and chromium are more abundant in the shale units. There is no apparent difference in zirconium or thorium concentrations between sandstone and shale units, or in calcium and magnesium, except where they lack carbonate cement or carbonate rock fragments. Data on the sandstones seem meaningless because of wide variability in proportion of grains and matrix and in relative amount of clay minerals, carbonates, and organic materials. Other elements provide little definitive information. Results may be improved by separation of clay content from the sandstones and making separate analyses. Boron was transported into the environment of deposition from alteration of primary source rocks, in illitic clays, so is useless as an indicator of environment of deposition of the Ada. — ESL

Irwin, W. P. *See* Wallace, R. E. 08154

Irwin, W. P. *See* Wallace, R. E. 08155

00430 **Isaacs, K. N.** New magnetometer defines sedimentary structures: World Oil, v. 170, no. 4, p. 79-81, illus., 1970.

A highly sensitive alkali type magnetometer can outline sedimentary stratigraphic and structural features. A description is given of this new exploration tool which will survey large areas at minimal cost. — GHD

00404 **Isphording, Wayne C.** Late Tertiary paleoclimate of eastern United States: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 334-343, illus., tables, 1970.

X-ray and petrographic information from land-derived Miocene and Pliocene deposits in northeastern and southeastern United States clearly reflects climatic conditions and verifies the conclusion that subtropical conditions did prevail as far north as northern New Jersey during the late Tertiary. Mineralogic evidence from Miocene sediments on the Florida platform indicates sediments were not derived from the Rocky Mountain drainage basin, but are detritus from the southern Appalachians and Piedmont. — *from* Author's abstract

08081 **Ito, Tei-ichi; Takeuchi, Yoshio; Ozawa, Toru; Araki, Takaharu; Zoltai, Tibor; Finney, J. J.** The crystal structure of axinite revised: Japan Acad. Proc., v. 45, no. 6, p. 490-494, illus., tables, 1969.

Specimens studied are from Woodlake, Calif. Electron microprobe analysis gives the Fe to Mn ratio as approximately unity. Lattice constants of the triclinic crystal are given. Methods of analysis are described in detail, and atomic parameters tabulated. The revised structure contains Si_4O_{13} groups, and the salient feature is that four of the pyrosilicate groups are joined together by boron atoms with tetrahedral coordination to form a large boro-silicate group $B_2Si_4O_{20}$. In this group, two Si_4O_{13} groups and two BO_4 tetrahedra form a hexagonal ring, parallel to (121), with a center of symmetry. The boro-silicate groups are bound together by Al, Fe, and Ca atoms. Four aluminum-oxygen octahedra and two iron-oxygen octahedra form a chain by sharing edges; the chains are joined together by Ca atoms. — ESL

00290 **Iyer, H. M.** Crust and upper mantle structure beneath LASA, Montana, based on traveltime, $dT/d\Delta$ and amplitude anomalies [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 105, 1970.

Jack, R. N. *See* Turner, D. L. 00382

00291 **Janda, Richard J.** Multiple approaches to computing denudation rates for the Waianae and Koolau Volcanoes, Island of Oahu, Hawaii [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 105-106, 1970.

Jansonius, Jan. *See* Pocock, Stanley A. J. 07847

Jensen, M. L. *See* Buddington, A. F. 08095

Jensky, Wallace. *See* Snyder, Henry. 00365

Johnson, G. Leonard. *See* Heezen, Bruce C. 08050

08118 **Johnson, Gary D.; Vondra, Carl F.** The Pella Formation, New Durham Quarry, *in* The many faces of geology — Tri-State [Geol.] Field Conf., 33d, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, p. 69-72, illus., 1969.

The stratigraphy of the Pella Formation, of late Valmeyran age, is described from the type locality in New Durham Quarry in Marion County, south-central Iowa. The St. Louis Formation, which underlies it, is also described and measured sections are included. — EH

08049 **Johnson, J. Peter, Jr.** Deglaciation of the central Nain-Okak Bay section of Labrador [with French and Russian abs.]: Arctic, v. 22, no. 4, p. 373-394, illus., 1969.

Glacial erratics on the highest peaks of the Nain-Okak Bay section of Labrador indicate that at one time the entire area was completely glaciated. This complete ice cover is tentatively correlated with the Torngat Glaciation. A subsequent ice advance from the interior of Labrador, during which the higher peaks were nunataks, would appear to correspond to the Koroksoak Glaciation, because distinct moraine systems at lower altitudes are apparently those of the Saglek Glaciation and its phases. Final deglaciation consisted basically of recession accompanying thinning of the ice sheet in the interior of Labrador with isolated masses of stagnant ice still occupying low lying areas when the eustatic rise of sea level began. — Author's abstract

Johnson, Tracy. *See* Oliver, Jack. 08009

Joiner, Thomas J. *See* Scarbrough, W. Leon. 07789

Jones, David L. *See* Bailey, Edgar H. 00225

Jovanovic, S. *See* Reed, G. W. 08075

07903 **Kaesler, Roger L.** Aspects of quantitative distributional paleoecology, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 99-120, illus., table, 1969.

Aspects of quantitative distributional paleoecology becoming computer-based are biofacies and biotope analysis; study of intraspecific variations of morphology with environment, geography, or stratigraphy; and study of population dynamics and survivorship. Recently cluster analysis, relative entropy mapping, canonical analysis and ordination techniques have been applied to paleoecological problems. Analysis of variance provides a powerful tool for study of intraspecific variation of morphology in paleontology, and can be combined with tests for determination of nonsignificant subsets of samples. Recently computer simulation methods have been used in study of population dynamics, relating differences in survivorship to environment. Studies of composition and structure of marine communities and relations between shell chemistry and environment are areas of paleoecological research needing quantification procedures. — *from* Author's abstract

Kalin, D. C. *See* Proctor, R. J. 00428

08024 **Karaflath, Leslie L.** The effect of volume change characteristics of soils on the bearing capacity of shallow footings [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2677B, 1969.

00292 **Karvinen, William O.** The structure of Lardeau group rocks at Albert Canyon, British Columbia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 106, 1970.

00411 **Kay, R.; Hubbard, N. J.; Gast, P. W.** Chemical characteristics and origin of oceanic ridge volcanic rocks: Jour. Geophys. Research, v. 75, no. 8, p. 1585-1613, illus., tables, 1970.

Major element, alkali metal, alkaline earth, rare earth, and nickel content of midocean-ridge rocks from 30° North on the Mid-Atlantic Ridge, Gorda Rise, Juan de Fuca Ridge, and equatorial East Pacific Rise are presented. Midocean ridge volcanic rocks are characterized by olivine tholeiite normative compositions with variable Al_2O_3 and total iron contents. Chondritic rare earth element relative-abundance patterns, with some depletion in La and Ba, are found in almost all samples. Negative europium anomalies correlate with high total rare earth contents. Observed variations in chemical composition are ascribed to shallow differentiation dominated by plagioclase and olivine. The major characteristics are ascribed to extensive partial melting at shallow depths in mantle material being intruded under the axial valley of the ridges. — *from Authors' abstract*

07970 **Keefer, William R.** General stratigraphy and depositional history of the Fort Union, Indian Meadows, and Wind River Formations, Wind River Basin, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 19-28, illus., 1969.

The three formation accumulated in the Wind River basin during Laramide deformation. The lower one, the Paleocene Fort Union, includes a basal shale, the middle Waltman Shale, and the upper Shotgun Member. The middle is lacustrine, the other two are fluviatile. The Indian Meadows Formation is largely clastic but has thin beds of algal-ball limestone. The Wind River Formation which forms the surface rock over 4,000 square miles of the basin, overlies the Indian Meadow unconformably, and its thickness ranges from a wedge edge to several thousand feet in the basin center; an unconformity also occurs within the formation, separating it into two members. This formation and the Indian Meadow are lower Eocene. Facies show the formations were deposited in a subsiding basin adjacent to rising mountains. — HRC

08153 **Keeler, Charles M.** Some physical properties of alpine snow: U. S. Army Corps Engineers Cold Regions Research and Eng. Lab. Research Rept. 271, 69 p., illus., tables, 1969.

This study was an attempt to measure, quantitatively the fundamental properties of grain size, shape, and fabric of mountain snow in Utah, and relate these to the index or derived properties of bulk density, shear and tensile strength, permeability for air, and the dielectric static permitivity and loss tangent. Despite numerous difficulties in defining fabric and quantifying it, it was possible to show that: snow strength is a function of bond area with a relationship in the low density range described by a given formula; and the rate of densification of low density snow can be explained in part by high stress concentrations (on the order of 10^7 dynes/cm^2) at intergranular contacts and by such factors as riming on crystals. This simplified the study *in situ* of effect of environmental factors of time, temperature, and gravitational stress. — *from* Author's abstract

00293 **Keller, Edward A.** Pool-riffle spacing in Dry Creek, near Winters, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 106-107, 1970.

08188 **Kennedy, Barbara A.** Periglacial morphometry, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 381-388, illus., 1969.

The origin and occurrence of various periglacial features are reviewed. Included are individual landforms, such as pingos, ground-ice slumps, orientated lakes, ice-wedge polygons, and naleds or icings. Also, such valley-side features as solifluction, nivation and snow bank hollows, and general valley asymmetry are described. — HRC

07925 **Kennedy, E. G.; Prior, J. W.** A combined geological-geophysical survey, northern Saskatchewan, *in* Guidelines to prospecting — A symposium: Canadian Mining Jour., v. 90, no. 4, p. 113, 118, illus., tables, 1969.

The history of uranium exploration in the Dianne Lake area, and discovery of silver are reviewed. All structures in the area apparently are related to the Charlotte River fault system, and rocks are mapped as part of the White Lake granite complex. Silver mineralization is confined to fractures in the diorite overlying the shear zone. The cause of the I. P. response was a mineralized shear zone 65-125 feet thick and 65 feet below the surface. Geophysical methods tested were induced polarization, low- and high-frequency E.M., and magnetic. It was decided to continue the pole-dipole I.P., magnetic, and high-frequency E.M. methods. Types of anomalies are described. The I.P. method outlined 17 anomalies, and recommendations were made for 10 drill holes. — ESL

07786 **Kennedy, John F.** The formation of sediment ripples, dunes, and antidunes *in* Annual review of fluid mechanics, V. 1: Palo Alto, Calif., Annual Reviews, p. 147-168, illus., tables, 1969.

The characteristics of bedforms, their shape, size, spacing downstream movement, and flow separation in the lee of each, are discussed along with their occurrence. Attempts to analyze the generation of bedforms can be divided into four categories. Development of an analytical model of bedform stability is presented, the dominant wave length is discussed, a summary of conditions for occurrence of various bed configurations tabulated, and fully developed bedforms are described. The equilibrium height of bedforms is fixed by factors not accounted for in the model. A discussion of current research directions and horizons concludes the paper. — ESL

07999 **Kent, B. H.** The geologic setting of a Pittsburgh coal mine in southwestern Pennsylvania, as related to roof rock conditions [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 122, 1969.

00441 **Keppie, J. Duncan.** The Martic thrust and the ages of the Wissahickon Schist and Octararo Phyllite — New structural data [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 1, p. 25-26, 1970.

Kienzlen, Geraldine. *See* McNulty, C. L. 07845

07873 **Kilinc, I. A.** Composition of melts formed from partial melting of shales and graywackes [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 125, 1969.

King, Charles W. *See* Merrill, Glen K. 07872

00294 **King, Chi-Yu.** Particle motion along a kinematic fault model [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 107, 1970.

King, Elizabeth R. *See* Brosgé, William P. 00469

King, L. H. *See* Rashid, M. A. 00479

King, William E. *See* LeMone, David V. 07843

08125 **Kirkby, M. J.** Erosion by water on hillslopes, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 229-238, illus., table, 1969.

Subsurface wash is of unknown, but probable minimal importance in slope erosion; surface wash between channels is mainly from raindrop impact, is dependent upon vegetation, and is unimportant. Only water flowing in channels is truly effective as a transporting and eroding agent. The average positions of channel heads over a period of time are controlled mainly by soil, slope gradient, precipitation, and vegetation cover. Vegetation plays an important role in the rate at which hillsides are eroded by running water, and the influence of man and climate is chiefly through their effect on changing the vegetation cover. — *from* Author's summary

Kirkwood, Samuel. *See* Swain, Frederick W. 00437

00295 **Kirsch, Stephen A.** The structure of Mineral Ridge, Esmeralda County, Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 107-108, 1970.

Kisslinger, Carl. *See* Nuttli, Otto W. 07837

Klement, Karl. *See* LeMone, David V. 07843

08002 **Knop, Osvald; Brisse, François; Castelliz, Lotte.** Pyrochlores – [Pt.] 5, Thermoanalytic, X-ray, neutron, infrared, and dielectric studies of $A_2Ti_2O_7$ titanates: Canadian Jour. Chemistry, v. 47, no. 6, p. 971-990, illus., tables, 1969.

A number of compositions of these titanates and related mixed phases were prepared and investigated. For trivalent lanthanons, the homogeneous phases were of the cubic pyrochlore type. Compositions of Bi, In, and Cr titanates were not cubic pyrochlores; results of X-ray and neutron examination of Sc titanate indicate further work is needed. Structures of Lu, Y, Gd, and Sm titanates were refined from X-ray powder data, and that of Er titanates was re-refined from published data without improvement. The positional parameter of the majority oxygen atom in these pyrochlores increases, and the distortion of the BO_6 octahedra decreases, with the increasing $r(A^{3+}):r(B^{4+})$ ratio, agreeing with the result obtained for Mössbauer spectra for A_2FeSbO_7 pyrochlores. Variation of frequencies of principal absorption bands in infrared spectra has been correlated with $r(A^{3+})$. —*from* Authors' abstract

Knop, Osvald. *See* Seidl, V. 08010

07904 **Koch, George S., Jr.** Computer applications in mining geology, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 121-140, table, 1969.

Computer applications in mining geology include the implementation of formal statistical procedures, as well as the editing, display and summarization of typically voluminous data. Besides the standard statistical procedures of estimation of means, variances and other parameters, calculation of confidence intervals, hypotheses tests and analyses of variance, mining geologists use less familiar statistical procedures. In mining exploration and delineation of ore deposits, these include such fields as multivariate analysis, operations research methods and analysis of trace element data (particularly gold assays). This review article emphasizes some less familiar procedures that may be of interest to geologists in other fields than mining. — Author's abstract

00296 **Kopf, Rudolph W.** Distinction between folded and abraded thrust faults [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 108, 1970.

08134 **Kopp, Otto C.** Preliminary analysis of the effects of regional metamorphism on the clay minerals of the Valley and Ridge and Blue Ridge Provinces of southeastern Tennessee [abs.]: Tennessee Acad. Sci. Jour., v. 44, no. 2, p. 49, 1969.

00457 **Kornfeld, J. A.** Gas, oil discoveries boost Canadian hopes: World Oil, v. 170, no. 4, p. 95-96, illus., 1970.

Recent gas and oil discoveries in Canada's Arctic Coastal basin have accelerated exploratory activity, particularly on the coast of the Beaufort Sea in the Mackenzie River delta area. The new finds have raised hopes for development of major significance in world oil geopolitics. The regional geology is summarized at the end of the article. — GHD

00297 **Korringa, Marjorie K.; Noble, Donald C.** Ash-flow eruption from a linear vent area without caldera collapse [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 108-109, 1970.

00298 **Kovacs, W. D.; Seed, H. Bolton; Idriss, I. M.** The response of clay banks to harmonic excitation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 109, 1970.

07908 **Krumbein, W. C.** The computer in geological perspective, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 251-275, illus., table, 1969.

From early use of digital computers applied to relatively simple statistical analysis mainly in stratigraphic analysis and sedimentology, automatic data processing procedures have spread to most fields of geology. More sophisticated programs were developed for analyzing data, and the conventional polynomial model for map analysis was supplemented by double Fourier series and by cross-spectral analyses. Now it becomes possible to examine geological uses of the computer by field, mathematical or statistical technique, diversity of underlying models, and in other ways that bring out close relations of the computer to virtually all aspects of geological research, including a great variety of practical applications, especially in exploration for oil, gas, and ores. — from Author's abstract

Krummenacher, Daniel. *See* Gastil, Gordon. 00266

00299 **Krummenacher, Daniel; Gastil, Gordon.** Reconnaissance potassium argon dates for basement rocks in the State of Baja California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 109, 1970.

00488 **Kuehn, Jack; Walper, Jack.** The Marble Canyon igneous complex, Culberson County, Texas [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 336-337, 1970.

Kulm, L. D. *See* Duncan, John R. 00439

Kume, Jack. *See* Hansen, Dan E. 00447

08103 **Kuno, Hisashi.** Mafic and ultramafic nodules in basaltic rocks of Hawaii, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 189-234, illus., tables, 1969.

The mafic and ultramafic nodules of Hawaii are (1) a lherzolite series, (2) a wehrlite series of dunite, wehrlite, and pyroxenite, (3) an eclogite series of pyroxenite and eclogite, and (4) a gabbro group. The lherzolite series constitutes the major part of the upper mantle. The chemical variation cannot be entirely explained by the subtraction of basalt erupted in the volcanoes, but some of the lower $Mg0/\Sigma Fe0$ members of the lherzolite series could be the source of the basalt. The hypothetical primordial mantle material "pyrolite" is close in composition to some lherzolites. The lherzolites differ from the wehrlites in the compositions of the clinopyroxenes. The eclogite series is distinct from the lherzolites in its trends of compositional variation, and constitutes a pocket or pockets within the lherzolite at depths between 40 and 60 km where some mafic magma was trapped. The gabbro nodules are fragments of the crust. —*from* Author's abstract

Kvenvolden, Keith. *See* Ponnamperuma, Cyril. 07997

00300 **Kvenvolden, Keith A.; Peterson, Etta; Brown, Frederick S.** Amino acid enantiomers in Recent and ancient sediments [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 110, 1970.

Kwon, Tai H. *See* Odegard, Mark E. 08148

Labotka, T. C. *See* Langenheim, R. L., Jr. 00303

07851 **Lachenbruch, Arthur H.; Marshall, B. Vaughn.** Heat flow in the Arctic, *in* U. S. Naval Arctic Research Lab. Dedication Symposium, Fairbanks, Alaska, 1969, Proc.: Arctic, v. 22, no. 3, p. 300-311, illus., 1969.

Heat flow measurements from the north slope of Alaska are analyzed and it becomes clear that measurements determined from gradients taken in the upper 100 m would

fail, as these gradients do not reflect steady flux from the Earth's interior, but rather climatic fluctuations. Various intervals of cooling have been detected, and a climatic warming is shown in the curves. The effects of bodies of water in the regions of permafrost are more important to measurements than climatic warming, however. Near frozen shorelines, large amounts of heat enter the Earth from subsurface unfrozen water, whereas the surface water is frozen, and such heat could be mistaken for heat originating in the Earth's interior. Heat flow measurement in the oceanic water is relatively simple, and some results are given for the Arctic Ocean. Such measurements suggest that the Alpha Rise is basaltic as might be expected in an extinct midocean ridge. — HRC

07894 **Ladd, Harry S.; Tracey, Joshua I., Jr.; Gross, M. Grant.** Deep drilling on Midway atoll: U. S. Geol. Survey Prof. Paper 680-A, p. A1-A22, illus., tables, 1969.

Two deep drill holes through reef limestones and underlying clays into basalts establish a geologic section for the Hawaiian Islands that extends back through the Miocene. The volcanic mound was partly truncated by wave action in pre-Miocene time, after which subsidence began. As the mound sank, weathered clays were reworked in shallow water and eventually were covered by reef limestones. Overall submergence was interrupted by emergence during the Miocene and the Pleistocene. During periods of emergence, the limestones were leached and recrystallized. The lower part of the post-Miocene limestone is extensively dolomitized; the Miocene limestone is irregularly dolomitized. The altered limestones were covered by 200 feet of younger reef limestones. Eroded remnants of an emergent Holocene reef are found on most of Midway's rim. — *from* Authors' abstract

00301 **Lahoud, J. A.; Orphal, D. L.** Seismic motions generated by the Milrow detonation, Aleutian Islands [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 110, 1970.

Lajoie, K. R. *See* Christensen, M. N. 00244

00302 **Lamb, Thomas N.** Fossiliferous Triassic (?) meta-sedimentary rocks near Sun City, Riverside County, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 110-111, 1970.

07939 **Landon, Ronald A.** Application of hydrogeology to the selection of refuse disposal sites: Ground Water, v. 7, no. 6, p. 9-13, tables, 1969.

Selection of proper sites for sanitary landfills is a major part of the waste disposal problem, particularly as they might affect the surrounding surface and ground water. Leachate production is inevitable in the humid East and throughout most of the country. Suggestions made that would result in the assimilation of migrating leachate into the environment at tolerable limits or for its renovation prior to final discharge are: (1) knowledge of existing hydrogeologic conditions which would control rate and direction of leachate migration; (2) engineering the landfill by constructing low-cost facilities to collect and treat leachate; (3) limited collection facilities to supplement natural conditions. More emphasis should be given to hydrogeologic factors to ensure protection of environment, by requiring test drilling, monitoring, and consideration in engineering of landfills. — *from* Author's abstract

Lane, Michael A. *See* Potter, Donald B. 07815

Lange, Nixon. *See* Gisler, Patrick. 00271

00303 **Langenheim, R. L., Jr.; Brackin, W. P.; Granath, J. W.; Labotka, T. C.** Geology of the Bristol mine area and the Silverhorn mining district, Lincoln County, Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 111, 1970.

07963 **Langer, Arthur M.; Bowes, D. R.** Polyphase deformation in the Manhattan Formation of Manhattan Island, New York City, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 361-377, illus., 1969.

Three deformation phases have been separated, and time relations and geometrical form of the three sets of folds and associated planer and linear structures elucidated on the basis of field observations and structural analysis. Regional metamorphism with development of dominant foliation, axial plane to isoclinal folds, was associated with the earliest Riverside Fold Phase. The most prominent and commonly developed folds were formed in a second or Central Park Fold Phase. Banding and dominant foliated were deformed, and trend of axes of these folds generally correspond with trend of the Appalachian Mts. In the third phase, or Park South Fold Phase, open symmetrical folds formed; effects on pre-existing structures were largely minor. The great range in ages of metamorphism of the Manhattan Formation is attributed to varying effects of the three phases on isotope proportions — *from* Author's abstract

07766 **LaPrade, George L.; Leonardo, Earl S.** Elevations from radar imagery: Photogramm. Eng., v. 35, no. 4, p. 366-371, illus., 1969.

Radar is a ranging device while the camera is an angle-measuring device. This difference means that entirely different relationships are used for elevation measurements. As radar provides its own source of illumination, it also has capabilities not available with conventional cameras. For example, under certain circumstances, the height of vertical features can be determined solely from the image itself with no knowledge of the radar system or aircraft position. Radar additionally can have either slant or ground range images. Each type of image requires the use of different geometrical relationships. This paper develops the mathematical expressions for measuring the heights of vertical and nonvertical features with both slant- and ground-range images. Significant applications are discussed and the experimental accuracies obtained in actual practice are given. — Authors' abstract

07955 **Larsen, Leonard H.; Prinz, Martin; Manson, Vincent.** (editors). Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, 561 p., illus., tables, geol. maps, 1969.

This volume, edited and authored by Poldervaart's students and friends, contains nineteen papers (cited separately) dealing with a wide range of subjects, reflecting the range of interests of Arie Poldervaart. — HRC

07956 **Larsen, Leonard H.; Prinz, Martin.** Arie Poldervaart — 1918-1964, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. xi-xiii, portrait, 1969.

Larson, E. R. *See* Olson, G. H. 00329

07805 **Lawrence, Myron W.** Earth crustal movements by precision analytics: Photogramm. Eng., v. 35, no. 3, p. 263-274, illus., tables, 1969.

This report gives the results of an investigation to determine the technical feasibility of a photogrammetric method to detect small relative earth movements such as those encountered in earthquake fault areas. An indication of the precision and accuracy of the method is given by the consistency of the results of several different photogrammetric models that were reduced, and by a direct comparison of these results with values obtained by a geodetic survey. Results indicate that earth movements in excess of 1 mm in a 12 × 24-m area can certainly be detected. Field procedures, data reduction results, conclusions, and recommendations are included. — Author's abstract

00304 **Lee, W. H. K.; Roller, J. C.; Eaton, J. P.** Microearthquake mapping of the San Andreas fault system in central California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 111-112, 1970.

Lee, W. H. K. *See* Stewart, S. W. 00372

07811 **LeFleur, Robert G.** Glacial geology of the Schoharie Valley, Trip 5 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 5-1 — 5-20, illus., 1969.

Glacial drainage in the Schoharie Valley was toward the north, toward the ice, having several sharply defined notches along its southern divide through which glacial drainage later spilled, and also having several shallow cols along the northeastern divide through which reinvasions of Hudson Valley ice passed. A complex record has resulted, and a field trip of 16 stops is outlined to visit many of the locations. No road log is included, but detailed descriptions of each of the stops, identified by quadrangle location, are given. — HRC

Leitner, Charlotte: *See* Price, Vaneaton, Jr. 07870

07843 **LeMone, David V.; Klement, Karl; King, William E.** The phylloid algal mounds of the upper member, Hueco Limestone, southern Robledo Mountains, Dona Ana County, New Mexico [abs.]: Texas Jour. Sci., v. 20, no. 3, p. 289-290, 1969.

00472 **Leonard, Robert B.; Morgan, Charles O.** Application of computer techniques to seepage-salinity surveys in Kansas: Kansas Geol. Survey Spec. Distrib. Pub. 47, 44 p. tables, 1970.

Calculation and tabulation of potentially significant parameters by computer techniques promote more efficient analysis and presentation of a large amount of data from seepage-salinity surveys than would be practical using manual methods. Output from computer programs written in FORTRAN IV and GMAP languages is readily adaptable to the objectives of individual investigations. — Authors' abstract

Leonardo, Earl S. *See* LaPrade, George L. 07766

07964 **Leveson, David J.; Seyfert, Carl K.** The role of metasomatism in the formation of layering in amphibolites of Twin Island, Pelham Bay Park, The Bronx, New York, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 379-399, illus., tables, geol. map, 1969.

Felsic gneisses, sillimanite schists, and amphibolites were subjected to three phases of deformation and metamorphism. During the third, compositionally distinct layers were produced in the amphibolites from metasomatism. The layers superficially resemble primary layering in para-amphibolites and also resemble secondary layering from metamorphic segregation during an early phase of deformation. Evidence for metasomatic origin includes gradation over short distances both across and along strike into amphibolite, replacement textures, mineral assemblages unlike those resulting from metamorphism of sedimentary and volcanic rocks, and presence of relict formations and skialiths. The layers occur either in hinge zones of F_3 folds or at the ends of amphibolite layers separated by boudinage on the F_3 folds. — *from* Authors' abstract

08045 **Levitt, Stephen Robert.** The vibrational spectroscopy and normal coordinate analysis of geological apatites [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2873B-2874B, 1969.

00452 **Levy, Enrique.** La metalogenesis en América Central [with English abs.], *in* Mapa metalogenético de América Central, 1:2,000,000; Estudios metalogenéticos de América Central: Inst. Centroamericano Inv. y Tecnología Indus. Pubs. Geol., no. 3, p. 17-57, illus., table, 1970.

Central America is divided into four metallogenic provinces: (1) Northern Sierras where late Paleozoic to post-Laramide deposits include gold-quartz veins in Honduras, cassiterite in Belice, ilmenite in Guatemala, base- and precious-metals in Nicaragua and Honduras, and nickeliferous laterites and gold placers in Guatemala, Honduras, and Nicaragua; (2) Volcanic Plateaus which have post-Laramide deposits of gold, silver, lead, zinc and copper sulfides, a porphyry copper-molybdenum deposit in Panama, and Quaternary deposits of aluminum laterites, gold placers and magnetite-ilmenite beach sands; (3) Southern Peninsulas and Darien which contain manganese deposits in Panama and Costa Rica and gold placers in the Osa Peninsula and in Darien; (4) Petén Basin, northern Guatemala, a large evaporite-carbonate

basin with gypsum the important known deposits, but with a potential for sulfur and potash.—*from* Author's abstract

Levy, Enrique. *See* Dengo, Gabriel. 00468

07831 **Levy, Michael.** Global seismicity movies (1961-1967) [abs.]: Earthquake Notes, v. 40, no. 4, p. II, 1969.

00305 **Lewis, B. R. T.; Meyer, R. P.; Gettrust, J.** Upper mantle structure along the axis of the Rocky Mountains [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 112, 1970.

07947 **Liao, K. H.; Scheidegger, A. E.** Branching-type models of flow through porous media [with French abs.]: Internat. Assoc. Sci. Hydrology Bull., v. 14, no. 4, p. 137-145, illus., table, 1969.

Some time ago the authors investigated [1968] a random-graph model for explaining the mechanics of flow through porous media. In the present paper this earlier approach is further extended: first, to the discussion of a three-dimensional random-graph model and second, to an investigation of lateral dispersion in porous media. Comparisons with experimental results are given. — Authors' abstract

07883 **Lind, Aulis O.** Coastal landforms of Cat Island, Bahamas: Chicago Univ. Dept. Geography Research Paper 122, 156 p., illus., tables, 1969.

The purpose of the study was to examine the coastal landforms of Cat Island, in the outer islands of the Bahamas and to interpret them within the perspective of repeated sea-level fluctuations in Holocene times. A general description is given of the geology, vegetation, climate, soils, marine environments, landforms, deposits and depositional features, and topography. The storm and eustatic hypotheses of the evolution of Holocene landforms are compared and evidence from the author's study given to support the eustatic theory. — EH

08068 **Lindt-Muehlemann, C.; Oeschger, H.** Messung der Tritiumaktivität der angereicherten Grönland-Eisproben, *in* Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, 54-61, illus., 1969.

A technique and apparatus for measuring the tritium content of Greenland ice samples are described. Accuracy of measurement was within 2 percent. — JWC

08033 **Lins, Thomas Wesley.** Phanerozoic batholiths — Where and why [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2761B, 1969.

00306 **Lipman, Peter W.; Prostka, Harold J.; Christensen, Robert L.** Cenozoic volcanism and tectonism in the western United States and adjacent parts of the spreading ocean floor — Pt. 1, Early and middle Tertiary [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 112-113, 1970.

Lipman, Peter W. *See* Christiansen, Robert L. 00434

08000 **Livingston, Donald Everett.** Geochronology of older Precambrian rocks in Gila County, Arizona [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 5, p. 2252B, 1969.

08077 **Livingston, Vaughn E., Jr.** Geologic history and rocks and minerals of Washington: Washington Div. Mines and Geology Inf. Circ. 45, 42 p., illus., tables, 1969.

A description of the physiographic provinces of the state precedes a general geologic history, which is summarized in a table. Rocks of Precambrian through Devonian age are present only in northeastern Washington. The sea covered various parts of the state from Carboniferous through Cretaceous times; during the Cretaceous and Tertiary the Okanogan Highlands were uplifted and major faulting occurred. The sea covered the western part from Eocene to Miocene times, attaining its present posi-

tion in Pliocene and Pleistocene. At this time major mountain ranges were formed, volcanoes were active and the continental ice sheet affected the land surface. Recent alluvial deposits, young lava flows, volcanic breccia and ash are widespread. Most mineral deposits are in the northern part of the state and in the Cascade Mountains; lead, zinc, and uranium and magnesium minerals are mined in the northeast, chiefly in Stevens County. Many other minerals and building materials are available. Substantial reserves of subbituminous coal and insignificant amounts of oil and natural gas are located in western Washington. — EH

Lockwood, John P. *See* Moore, James G. 00317

Loh, Y. T. *See* Anderson, A. 07827

08115 **Lohnes, Robert A.** Soil mechanics and natural slopes, *in* The many faces of geology — Tri-State [Geol.] Field Conf., 33d, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, p. 40-49, illus., 1969.

The application of soil mechanics to the study of slopes has been aided by the recent invention of the borehole shear device, which provides soil shear strength data. Methods of slope stability analyses are reviewed and examples given as to how they may be applied to geologic problems. The author presents a slope-evolution model to provide a theoretical frame of reference for further research in relating soil mechanics to slope evolution. — EH

Loney, R. A. *See* Himmelberg, Glen R. 00285

Loney, R. A. *See* Himmelberg, G. R. 08001

Longwell, T. J. *See* Franzmeier, D. P. 07863

Losche, C. K. *See* Franzmeier, D. P. 07863

07855 **Lovering, Thomas S.** Mineral resources from the land, [Chap.] 6 *in* Resources and man, a study and recommendations by the Committee on Resources and Man of the Division of Earth Sciences, National Academy of Sciences-National Research Council: San Francisco, Calif., W. H. Freeman and Co., p. 109-134, illus., 1969.

Estimating mineral and chemical resources involves many uncertainties; analysis of ore deposits is complicated by the factor of geologic time, involving many opportunities, by various processes, for both enrichment and dispersal. Reliability is obtainable for important dissolved salts in well-mixed oceans, and perhaps for fossil fuels and a few other sedimentary mineral deposits, but not for useful materials from the solid crust, especially metals. Some important characteristics of mineral deposits are discussed, with illustrations of difficulties and misconceptions that affect estimation of reserves; the order of magnitude of probable demand is considered, and some actions and cautions are suggested that might improve the future outlook for our mineral economy. — GDC

07938 **Luce, Charles F.** Ground water and government: Ground Water, v. 7, no. 6, p. 2-8, 1969.

Some of the findings of experts studying ground-water resources of the United States, and major problems and policy issues are outlined. In development, use and conservation of such resources, Federal and State governments must assume primary responsibility for basic research; the Water Resources Research Act of 1964 allows grants. The cooperation of Surveys, to delineate and evaluate important aquifers, is broadened by study of aquifer capacity for storing surface waters, injection to combat salt-water encroachment, artificial recharge, safe waste disposal, and use of saline waters. The Water Resources Planning Act of 1965 provided a basis for formulating comprehensive plans for optimum use of water resources, but emphasis has been on surface waters. States should assume control of ground-water withdrawals. The National Water Commission was authorized in 1968, to appraise Federal programs and policies and make recommendations to Congress and the President. — GDC

08034 **Ludman, Allan.** Geology of the Skowhegan quadrangle, Maine [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2761B, 1969.

07968 **Luth, W. C.; Tuttle, O. F.** The hydrous vapor phase in equilibrium with granite and granite magmas, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 513-548, illus., tables, 1969.

Composition of hydrous vapor in equilibrium with granite and water-saturated granite magmas has been determined up to 10,000 bars at temperatures above and below the solidus. At temperatures above solidus, silicate constituents are depleted in K-feldspar relative to 'normal granites.' The anydrous composition of the vapor phase in equilibrium with alkali feldspar and quartz at 2 kb is, in contrast, rich in silica; at 10 kb the anhydrous composition is approximately that of the liquid phase at beginning of melting. Addition of sodium disilicate to a synthetic granite composition at 5 kb, 650° C, was found to enhance solubility of water in granitic liquid, and of silicates in the aqueous vapor phase, suggesting continuous transition from magma to hydrothermal solution. These experiments bear on possible metasomatic changes expected near a granite pluton as well as on the process of forming of 'granite-looking' rocks. — *from* Authors' abstract

08047 **Lynch, John Douglas.** Evolutionary relationships and osteology of the frog family Leptodactylidae (Volumes I and II) [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2964B, 1969.

Lynch, R. D. *See* Davis, L. L. 00251

08035 **MacDonald, Harold Carleton.** Geologic evaluation of radar imagery from Darien Province, Panama [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2762B, 1969.

08157 **Macdonald, J. R.; Sibley, Gretchen.** Paleopathological ponderings, or how to tell a sick saber-tooth: Los Angeles County Mus. Nat. History Quart., v. 8, no. 2, p. 26-30, illus., 1969.

Evidences of diseases are often found in ancient fossil bones and plants. Tar pits such as La Brea drew a multitude of ancient animals with injured or diseased bones. Evidences of parasitism and hypertrophy are among the most ancient types. The oldest record of fracture is the front leg of a Permian reptile, *Dimetrodon*, mended by callus without shortening; such finds are most common in wolves and birds. The mended humerus of a Late Cretaceous dinosaur had signs of a fatal abcess. Skulls of biting cats often show saber-tooth wounds; that of an aged mammoth had an inch-deep dent of butter-plate size. A late Pleistocene bear cranium was completely out of shape. Fused cat vertebrae and a disfigured pelvis indicate bad infections. Other conditions include arthritis, evidences of tumors, abnormal sinuses and blood vessels, and calcified muscles. — GDC

08016 **MacGinitie, H. D.** The Eocene Green River flora of northwestern Colorado and northeastern Utah: California Univ. Pubs. Geol. Sci., v. 83, 203 p., illus., tables, 1969.

The middle Eocene flora here described occurs in upper members of the predominantly lacustrine Green River Formation — the upper part of the Parachute Creek member in Colorado and the equivalent part of the Evacuation Creek member in Utah. The megaflora contains 7 pteridophyte, 3 gymnosperm, 67 angiosperm species. Four vegetation groups are based on habitats of related living species: lake margins and floodplains; low, well-drained elevations; moderate elevations and north-facing slopes; elevations over 3,000 feet, represented largely by pollen, much of it from conifers. The climate indicated by flora and sediments was subtropical, bordering on subhumid, relatively dry in fall and winter and rainy in late spring and early summer, more equable than at present. The flora resembles most closely the early Oligocene Florissant flora. — VMJ

Mack, Lawrence R. *See* Thompson, Erik G. 00415

MacLeod, Norman S. *See* Snavely, Parke D., Jr. 07892

MacMillan, J. R. *See* Speed, R. C. 00367

07875 **Magnitsky, V. A.; Zharkov, V. N.** Low-velocity layers in the upper mantle, *in* The Earth's crust and upper mantle: Am. Geophys. Union Geophys. Mon. 13 (Natl. Acad. Sci.-Natl. Research Council Pub. 1708), p. 664-675, illus., 1969.

The validity of the existence of a low-velocity layer in the upper mantle, at depths of approximately 100 km, has been essentially proven, but whether it is continuous or not, whether it is totally absent in some areas, and the nature of the boundaries are still problematic. Analysis of thermodynamic parameters of the subcrustal layer, the distribution of pressure and temperature, and changes in seismic wave velocities suggests that relaxation of the shear modulus is a more likely explanation of the low-velocity layer than interpretation as a temperature effect or the product of chemical change. — MS

00307 **Major, M. W.; Butler, David; Blackford, M. E.** Residual strains associated with Milrow [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 113, 1970.

00308 **Maley, Richard P.** Recent developments in the Coast and Geodetic Survey's program in strong-motion seismology [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 114, 1970.

00309 **Maley, Richard P.** Strong-motion seismograph records of the Borrego Mountain earthquake from multi-story buildings in the Los Angeles area [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 114, 1970.

Malik, W. U. *See* Gupta, G. C. 08017

Manning, Robert A. *See* Statler, Anthony T. 08137

Manson, Vincent. *See* Larsen, Leonard H. 07955

08187 **Marcus, Melvin G.** The hydrology of snow and ice, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 359-367, illus., 1969.

A broad, incomplete picture of the characteristics, distributions, and processes relating to snow and ice is given. The general subjects reviewed are: properties of snow and ice and distribution, and snow and ice as an input-output system, which includes glacier mass balance and seasonal snow cover. — HRC

00310 **Marjaniemi, Darwin K.** Denuded caldera in the Basin and Range of Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 116, 1970.

Mark, Norman. *See* Odegard, Mark E. 08148

08105 **Markov, K. K.** Geographical regions and zones and their Quaternary development [with German abs.], *in* Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, p. 3-5, illus., 1969.

The pattern of cooling of the Earth's surface during the Pleistocene was very irregular. The maximum cooling was 50-60°C in the northern hemisphere and 4-7°C in the equatorial zone. Cooling was not great in the southern hemisphere, especially in Antarctica. Periods of dry climate in certain regions (e.g., the periglacial zone) were synchronous with periods of wet climate in other regions (e.g., the pluvial zone). Thus, natural changes had a very local character in the Pleistocene. — Author's abstract

Marlow, Michael S. *See* Scholl, David W. 00359

00420 **Marranzino, A. P.; Nakagawa, H. M.** Analytical methods, *in* A geochemical study of alluvium-covered copper deposits in Pima County, Arizona: U. S. Geol. Survey Bull. 1312-C, p. C11-C13, 1970.

Both geochemical prospecting tests (colorimetric analyses) and spectrographic analyses were made on samples collected in Pima County; details given here are for only the geochemical prospecting tests which depart from published descriptions. The test for copper is the biquinoline method of Almond (1955) with slight modifications; molybdenum in water was determined by the thiocyanate method (Nakagawa and Ward, 1960) but without concentration on an ion-exchange resin; and molybdenum in plants was termined on the ash by using the thiocyanate method of Reichen and Ward (1951), slightly modified. — MCM

Marshall, B. Vaughn. *See* Lachenbruch, Arthur H. 07851

07982 **Martin, W. B.; Shaughnessy, Jack.** Project Wagon Wheel, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 145-152, illus., 1969.

The project is designed to test the feasibility of stimulating gas production in otherwise poorly-producing Mesa Verde Formation units by the explosion of a nuclear device underground in the well. The reservoir characteristics of several units within the formation are discussed, as is the structure, a very complex anticline and a high-angle fault. The site was selected on the basis of: proximity to thick-bedded sand reservoirs, a favorable structural position with respect to permeability and porosity in the Blair Member, favorable position with respect to subsurface structures, distance from the town of Pinedale, absence of mobile water below 7,200 feet, proximity to a deep well, and proximity to an all-weather highway. — HRC

08138 **Martin, W. H.** Forest communities in the Ridge and Valley province of east Tennessee — A preliminary report [abs.]: Tennessee Acad. Sci. Jour., v. 44, no. 2, p. 45, 1969.

Massey, H. F. *See* Barnhisel, R. I. 08158

08064 **Matalas, N. C.** Systems analysis in water-resources investigations, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 143-159, 1969.

Within the past decade, the approach to planning and management of water-resource systems through the framework of systems analysis characterized by interacting and complementary roles of economics, engineering, and hydrology, has introduced new computational and mathematical techniques involved in such procedures as optimization and simulation. Systems analysis of large-scale water-resource systems is based on mathematical models to extend usefulness of existing data related to physical, chemical, biological, social and economic phenomena; its increasing use is linked closely to developments in capabilities of high-speed, large-memory digital computers. Although systems analysis and computer applications are independent, computers are being used more extensively to assess larger ranges of feasible alternative schemes in the development of water resources. — *from* Author's abstract

Matthews, Jerry L. *See* Winterer, Edward L. 07996

00311 **Mattinson, James M.** Uranium-lead geochronology of the Northern Cascade Mountains, Washington [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 116, 1970.

Mauger, R. L. *See* Buddington, A. F. 08095

07826 **McAndrews, John H.** Paleobotany of a wild rice lake in Minnesota: Canadian Jour. Botany, v. 47, no. 11, p. 1671-1679, illus., 1969.

Four pollen zones present in a 360-cm core from Rice Lake, Becker County, indicate a vegetation succession from mid-postglacial oak savanna to deciduous forest to pine-hardwood forest to an uppermost ragweed zone representing postsettlement forest disturbance. Seeds of wild rice occur in the upper meter with abundant wild

rice type pollen, the initial increase of which is C-14 dated 2450±100 years ago. The ragweed pollen rise dating land settlement about 75 years ago is C-14 dated at 590±95 years. The difference is attributed to contamination and when this error is subtracted from the older date, the spread of wild rice across the lake is dated at 1935±100 years. An extensive stand of wild rice predates by 1000 years prehistoric cultures known to have used it. Its spread is probably due to either climatic change with changes in water quality or to shallowing of the lake by sedimentation, or both. —*from* Author's abstract

McAtee, James L., Jr. *See* Chou, Chung Chi. 08011

McCoy, Roger M. *See* Dalke, George, W. 07767

McCulloch, David S. *See* Carlson, Paul R. 00241

00312 **McEldowney, Roland C.** An occurrence of Paleozoic fossils in Baja California, Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 117, 1970.

McEvilly, T. V. *See* Zanetti, John. 00394

00403 **McGill, George E.** Belt Supergroup correlation, Helena to Glacier National Park, Montana: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 349-352, illus., 1970.

Recent mapping and stratigraphic studies have resulted in revision of the Belt stratigraphy in the Lewis and Clark Range of western Montana. In this revision the Siyeh Formation is correlated with the Helena Formation rather than with the Newland Formation. The revision facilitates the correlation of Belt formations of the Glacier National Park, Bonner and Helena areas, and indicates the presence of a small number of relatively widespread carbonate formations in the Belt supergroup. —*from* Author's abstract

07891 **McIlhenny, W. F.** Ocean and beaches, a ready source of raw chemical and mineral materials: Offshore, v. 29, no. 5, p. 56-57, 59-60, 62, 198-199, illus., tables, 1969.

Useful materials can be recovered from sea water, from the beaches and near ocean floor, from beneath the floor, and from the deep sea. Twelve dissolved components of sea water are being recovered, with salt the largest in value. Deposits of heavy minerals in beach sands and their origin are described; they also occur on submerged Pleistocene beaches. Sand and gravel and marine shell are recovered in shallow water in bays and off the coast. Continental shelf deposits include phosphorite and barite nodules. Minerals obtained by drilling beneath the shelf, principally sulfur and petroleum, represent the largest segment of the industry. Manganese and iron nodules cover millions of square miles of deep-sea floor. Marine mining methods and the impact of new technology are discussed. — ESL

00448 **McIlwaine, W. H.** Operation Maple Mountain — Whitson Township, District of Timiskaming: Ontario Dept. Mines Prelim. Geol. Map P. 580, scale 1 in. to 1/4 mi., text, 1970.

Oldest bedrock in the Whitson Township is the Lorrain Formation of the Cobalt Group, essentially flat lying and consisting of sandstone. Nipissing Diabase intrudes the Lorrain and crops out in the northwestern and southeastern sections. Bedding in the Lorrain has gentle dips, with 25° the maximum observed; fault trends show three main directions: N-S, NW, and NE. Main mineralization is native silver in carbonate veins localized along fractures in the Nipissing. — MCM

00453 **McIlwaine, W. H.** Operation Maple Mountain — Speight Township, District of Timiskaming: Ontario Dept. Mines Prelim. Geol. Map P. 573, scale 1 in. to 1/4 mi., text, 1970.

With the exception of a small inlier of presumed Archean granite east of Munroe Lake all bedrock in Speight Township is Proterozoic. Most of the area is underlain by

the Lorrain Formation of the Huronian Supergroup, intruded by Nipissing Diabase. Sediments of the Lorrain have a regional dip to the west; two main directions of faulting are NE and NNW. Native silver with associated cobalt-nickel-iron-arsenides in carbonate veins in the Nipissing is the only known mineralization. — MCM

00467 **McIlwaine, W. H.** Operation Maple Mountain — Auld Township, District of Timiskaming: Ontario Dept. Mines Prelim. Geol. Map P. 579, scale 1 in. to 1/4 mi., text, 1970.

The Lorrain Formation of the Huronian Cobalt Group (mostly arkose) underlies most of Auld Township; Nipissing Diabase, mainly quartz diabase, intrudes the Lorrain. Gentle dips reach a maximum of 20° and have a regional westerly dip; local variations are due to folding and faulting. Silver mineralization occurs in two calcite vein systems at the Triangle mine. — MCM

07905 **McIntyre, D. B.** Computer applications and developments in petrology [abs.], *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 141, 1969.

00313 **McKee, Edwin H.; Naeser, C. W.** K-Ar and fission-track dates of Tertiary ash-flow sheets — Comparison and evaluation of the methods [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 118, 1970.

00314 **McKee, Edwin H.; Silberman, Miles L.** Tertiary igneous activity in north-central Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 118-119, 1970.

07814 **McLelland, James.** Geology of the southernmost Adirondacks, Trip 11 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 11-1 — 11-34, illus., table, 1969.

Nine lithologic units are mapped and described; all are crystalline but very little is magmatic in origin. Complex multiple folding and faulting is present. A road log for a field trip of 70 miles makes 10 stops, each discussed briefly. The area under consideration contains most of the Gloversville and Lassellsville quadrangles and the southern halves of Mount Pleasant and Piseco quadrangles. — HRC

07845 **McNulty, C. L.; Kienzlen, Geraldine.** An enchodid mandible from the Eagle Ford Shale, Dallas County, Texas [abs.]: Texas Jour. Sci., v. 20, no. 3, p. 290, 1969.

00489 **McNulty, C. L., Jr.** A new cylindracanthid rostrum from the Eagle Ford Shale (Turonian), Dallas County, Texas [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 337, 1970.

00400 **McWilliams, Robert G.** Evidence for thrust faulting in northern Olympic Peninsula, Washington: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 344-349, illus., 1970.

New mapping of Tertiary rocks between Agate Bay and Freshwater Bay, Clallam County, Washington, shows that several apparent stratigraphic anomalies, such as erratic distribution of formations, thinning of formations and older rocks lying on younger rocks, exist in the region. These relations suggest that thrust faulting is an important factor in the interpretation of the structure and stratigraphy of the region. — SEF

Meisburger, Edward P. *See* Duane, David B. 08183

08078 **Mellor, Malcolm.** Foundations and subsurface structures in snow — Cold Regions Sci. and Eng. Mon. III-A2c: Hanover, N. H., U. S. Army Corps Engineers Cold Regions Research and Eng. Lab., 55 p., illus., 1969.

Various types of foundations suitable for use in very deep snow are described, and design principles are given. Dependence of settlement rate on heaving pressure, size and shape of foundation, snow temperature, and snow density is treated analytically, and field data from test procedures for foundation design are outlined. In treating the design of tunnels, shafts and subsurface structures in very deep snow, the distribution of stress, strain and displacement of polar ice sheets are first obtained analytically. Observed patterns of deformation are given for a variety of excavations and deformable structures [in Greenland and Antarctica], and methods of analysis are put forward. The loading of restraining structures is discussed, and finally some notes on the monitoring and maintenance of subsurface structures are given. — Author's abstract

07804 **Merifield, P. M.** (editor). Satellite imagery of the Earth: Photogramm. Eng., v. 35, no. 7, p. 654-668, illus., 1969.

Photography of the Earth from spacecraft has application to both atmosphere and Earth sciences. Gemini and Apollo photographs have furnished information on sea surface roughness, areas of potential upwelling and oceanic current systems. Regional geologic structures and geomorphologic features are also recorded in orbital photographs. Infrared satellite imagery provides meteorological and hydrological data and is potentially useful for locating fresh water springs along coastal areas, sources of geothermal power and volcanic activity. Ground and airborne surveys are being undertaken to create a basis for the interpretation of data obtained from future satellite systems. — Author's abstract

Merlivat, L. *See* Dansgaard, W. 07914

07872 **Merrill, Glen K.; King, Charles W.** Platform conodonts from the lowest Pennsylvanian rocks of northwestern Illinois [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 149-150, 1969.

Merschat, Walter R. *See* Yeats, Robert S. 00392

00315 **Meyer, C. E.; Naeser, C. W.** Oligocene trachytes of northwestern Humboldt County, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 119, 1970.

Meyer, R. P. *See* Lewis, B. R. T. 00305

07906 **Miesch, A. T.** The constant sum problem in geochemistry, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 161-176, illus., table, 1969.

No method is known to identify variables that are correlated petrographically or geochemically. The method of Chayes and Kruskal (1966) may be used to test the hypothesis that no variables in a specific geochemical problem are correlated in excess of correlation attributed to effects of the constant sum in the geochemical data array. Where the hypothesis is accepted, no further examination or analysis of correlations for geochemical significance seems warranted, but where the hypothesis is rejected, no information is obtained regarding the statistical or geochemical significance of individual correlations and the pairs of variables that are correlated geochemically cannot be identified. The fundamental cause of the constant sum problem is that proportions, percentages, and other conventional geochemical variables are actually highly complex ratios containing variables in their denominators representing all constituents of rocks being examined. — *from* Author's abstract

Miles, Robert D. *See* Rib, Harold T. 07764

07934 **Milici, Robert C.** Middle Ordovician stratigraphy in central Sequatchie Valley, Tennessee: Southeastern Geology, v. 11, no. 2, p. 111-127, illus., table, 1969.

Middle Ordovician strata of central Sequatchie Valley, Tennessee, consist of the Pond Spring Formation, Murfreesboro Limestone, Ridley Limestone, Lebanon Limestone and Carters Limestone of the Stones River Group; and the Hermitage Formation, Cannon Limestone and Catheys Formation of the Nashville Group. The

1,350 foot thick sequence is predominantly carbonate and is correlative to the Chickamauga Supergroup at Chickamauga, Georgia. [Four measured sections are included.] — Author's abstract

08058 **Milici, Robert C.** Geologic map (and coal map) of the Sampson quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 103-NE, 2 sheets, scale 1:24,000, separate text, 1969.

The coal map shows the Sewanee seam with data on the Lantana, Richland, Wilder, and Bon Air seams; only the Sewanee and Bon Air have been mined or prospected in the Sampson quadrangle, and all mining and all known reserves are in the Sewanee seam. Recoverable reserves are estimated to be about 18 million tons with thickness more than 28 inches. Dimension sandstone is obtained from the Newton Sandstone. Potential resources are limestone, sand, and shale. — MCM

Miller, G. A. *See* Allen, W. H., Jr. 08170

08020 **Miller, Norton George.** Late- and postglacial vegetation change in southwestern New York State [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2565B, 1969.

Mills, W. R. *See* Caldwell, R. L. 07998

Milne, W. G. *See* Smith, W. E. T. 08084

00416 **Minear, John W.; Toksöz, M. Nafi.** Thermal regime of a downgoing slab and new global tectonics: Jour. Geophys. Research, v. 75, no. 8, p. 1397-1419, illus., 1970.

Using a quasi-dynamic computational scheme and a finite difference solution of the conservation of energy equation we have determined the effects of spreading rate, adiabatic compression, radioactivity, phase changes, and strain heating on the temperature regime of a downgoing lithosphere slab in an island arc region. Effects of these parameters on surface heat flux, gravity anomalies, and local seismic traveltime are estimated also. Predicted traveltime anomalies show good agreement with observed anomalies in Japan and Tonga-Kermadec. Several implications on the localized mechanical behavior of the upper mantle and the evolution of a downwarping slab are made on the basis of our computational results. — *from* Authors' abstract

08090 **Mobasheri, F.; Shahbazi, M.** Steady-state lateral movement of water through the unsaturated zone of an unconfined aquifer: Ground Water, v. 7, no. 6, p. 28-34, illus., tables, 1969.

In a steady-state condition the lateral flow rate through the unsaturated zone of an unconfined aquifer increases with a decreasing rate as the depth of the unsaturated zone increases while hydraulic gradient is kept constant. This flow rate reaches a maximum as the depth of the zone is increased. This maximum flow rate is computed by various methods such as an aquifer model, graphical integration of the characteristic hydraulic conductivity curve and flow net diagram. Based on these calculations a simple method is outlined for estimation of steady-state flow through the unsaturated zone of an unconfined aquifer. It is also concluded that in shallow unconfined aquifers the contribution of the flow through the unsaturated zone to the total lateral flow can be significant. — Authors' abstract

08175 **Moberly, Ralph, Jr.; Campbell, J. Frisbee.** Hawaiian shallow marine sand inventory — Pt. 1, Introduction; Pt. 2, Ahu o Laka sand deposit, Kaneohe Bay, Oahu: Hawaii Inst. Geophysics Rept. HIG-69-10 (Sea Grant 69-1), p. 1-10; 11-24, illus., table, 1969.

Shallow-water bodies of sand are being mapped around the Hawaiian Islands. This Sea Grant project is intended to encourage the exploitation of sand deposits that do not affect beaches. The project is described, and a bibliography of carbonate sands and reef structure is presented. Ahu o Laka sand body lies on the lagoonward edge of the large barrier-reef flat of Kaneohe Bay, Oahu. Jet probing indicates that the

deposit is not less than one million cubic yards in size. Our interpretation of preliminary seismic results and of the probable origin of the deposit suggests that it may actually be much larger. The sand compares favorably with other Hawaiian calcareous littoral sands. Exploitation of the body would not affect the shores of Kaneohe Bay, and probably would not disturb an adjacent proposed marine refuge. — Authors' abstracts

00316 **Moiseyev, Alexis N.** Geotectonic evolution of northern California — An alternate hypothesis [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 119-120, 1970.

07778 **Monson, A. P. B.; Sater, J. E.** (editors). Proceedings of the U. S. Naval Arctic Research Laboratory dedication symposium, Fairbanks, Alaska, 9-12 April, 1969: Arctic, v. 22, no. 3, p. 170-364, illus., 1969.

This symposium contains three papers on atmospheric sciences, five on Arctic marine science, seven on Arctic terrestrial sciences, and a closing address. Those pertinent to geological science are cited separately. — HRC

Moody, M. L. *See* Gibson, R. E. 00268

Moody, M. L. *See* Gibson, R. E. 00269

00463 **Moore, George T.** Role of salt wedge in bar-finger sand and delta development: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 326-333, illus., tables, 1970.

A linear, continuous deposit of fine and very fine sand, which occupies the channel and distributaries of the Mississippi delta, is termed a "bar-finger sand." Deposition of the sand occurs initially at the mouth of the river, forming distributary-mouth bars, and continues in tthe channel after the river has prograded beyond the original site of bar formation. This continuing process is postulated to be related directly to the annual discharge of the river. The intrusion of salt water into the channel during periods of less discharge reduces the carrying power of the river directly above its bed and causes deposition of the coarser sediments. Inasmuch as this phenomenon occurs during much of the year, it results in a net buildup of sand. — EAM

00317 **Moore, James G.; Lockwood, John P.** Geometry and genesis of Willow Lake-type banded rocks in the central Sierra Nevada, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 120-121, 1970.

00318 **Moores, E. M.; Wise, W. S.** Pre-batholith structure and stratigraphy of the Lake Almanor and Greenville quadrangles, northern Sierra Nevada — Progress report [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 121, 1970.

Morgan, Charles O. *See* Leonard, Robert B. 00472

Morrill, B. J. *See* Hofmann, R. B. 00286

08091 **Mortimer, C. H.** Physical factors with bearing on eutrophication in lakes in general and in large lakes in particular, *in* Eutrophication — Causes, consequences, correctives — Symposium [1967], Proc.: Washington, D.C., Natl. Acad. Sci., p. 340-368, illus., 1969.

The dynamics of diffusion, including turbulence; of oxygen balance, including redox control; and of nutrient gains and losses from the lake system are included in this review, emphasizing aspects of fluid dynamics that regulate exchange or transport mechanisms. Recent findings concern factors influencing mobilization and loss of phosphorus, and patterns of motion in large lakes insofar as they can influence rates at which eutrophication effects come to be felt in different regions of the lake. Nutrient influx is influenced by processes of rock-weathering and soil formation in the basin, such as leaching and erosion. The interface between oxidizing and reducing conditions in lakes lies a few millimeters below the sediment surface, as long as the water in contact there contains oxygen. Organic remains in sediments, and iron and manganese profiles reflect long-term changes. — GDC

00319 **Morton, D. M.** 1969 mudflows at Wrightwood, San Bernardino County, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 121-122, 1970.

00320 **Morton, D. M.; Baird, A. K.; Watson, K. D.** Carbonatite lenses within phlogopite-carbonate dikes, Mountain Pass, San Bernardino County, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 122, 1970.

Morton, D. M. *See* Murphy, M. A. 08072

Mueller, R. A. *See* Murphy, J. R. 00321

07926 **Muller, J. E.; Carson, D. J. T.** Geology and mineral possibilities of Vancouver Island: Canadian Mining Jour., v. 90, no. 5, p. 66-70, illus., table, 1969.

The island is underlain by two groups of predominantly volcanic rocks with some clastic and calcareous marine sediments, the Sicker Group, Pennsylvanian-Permian, and Vancouver Group, Triassic-Jurassic. The Westcoast Gneiss Complex, probably the product of Jurassic regional metamorphism of these groups, is intruded by batholiths and overlain by Cretaceous beds. Folding and faulting of several types are present. Important metals are Cu, Fe, Zn, Mo, Au, and Ag; classes of deposits present, tabulated and discussed, are: massive sulfides, iron and copper skarn, copper-molybdenum stockworks, molybdenum stockworks, porphyry copper, gold-quartz veins, Sooke copper. — ESL

Mullineaux, Donal R. *See* Crandell, Dwight R. 00248

00321 **Murphy, J. R.; Mueller, R. A.; Hays, W. W.** Characteristics of the seismic motions generated by the nuclear excavation detonations, Cabriolet, Schooner, and Buggy I [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 122-123, 1970.

08072 **Murphy, M. A.; Rodda, P. U.; Morton, D. M.** Geology of the Ono quadrangle, Shasta and Tehama Counties, California: California Div. Mines and Geology Bull. 192, 28 p., illus., geol. map, 1969.

Pre-Cretaceous igneous and metamorphic rocks of probable pre-Devonian to Late Jurassic age, crop out in the northern part of the quadrangle. Granitic rocks of a Late Jurassic batholith and ultrabasics of possible post-batholith age intrude rocks of probable Paleozoic age. Cretaceous marine sedimentary mudstones, siltstones and sandstones, with some conglomerates and limestones, comprise Budden Canyon Formation. Coarse clastics, forming outcrop belts, divide the formation into seven members. The rocks, which are progressivly younger and thin out toward the north and east, form an east- and southeast-dipping homocline, broken by faulting and folding. Faults trend north, northwest, and northeast. Sandstone dikes are numerous in the east. Nonmarine Cenozoic clastics, silts, sands and gravels, comprise the Red Bluff and Tehama Formations, the latter including the Nomlaki dacite tuff. Six post-Red Bluff terrace levels can be distinguished along major streams. — EH

07772 **Musgrove, Robert G.** Photometry for interpretation: Photogramm. Eng., v. 35, no. 10, p. 1015-1023, illus., 1969.

A three-part discussion outlines the potential uses of photometry to the photoanalyst. The first part concerns the use of a microdensitometer as a quick-response aid for interpreting features for which general identities are known, but for which exact properties cannot be determined. The second part concerns the process of determining the resolution of an aerial photographic system by subjecting high-contrast edges occurring within an imaged area to frequency analysis. The resultant output is the modulation transfer function which expresses system response as a function of frequency (cycles/mm). Finally photometry is applied to the mapping of offshore underwater areas. An account of an early research effort accompanies a description of current and future work. — Author's abstract

08116 **Myers, James D.** Geology and highway construction, *in* The many faces of geology — Tri-State [Geol.] Field Conf., 33d, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, p. 50-55, illus., 1969.

This article describes the work of the Geologic Section of the Iowa State Highway Commission in prospecting, production, and research of aggregates for road building. Geologists of the Commission study cores from likely sites, test rock samples, and recommend production procedures. A geologic section, core tests, and the development history of the Weaver Quarry, Hamilton County, are given. — EH

08173 **Nace, R. L.** World water inventory and control, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 31-42, illus., tables, 1969.

A general discussion of the occurrence of water on the Earth includes a table of percentages. Water vapor is 0.0001; world ocean, 97.6; rivers, 0.001; fresh-water lakes, 0.0094; saline lakes and inland seas, 0.0076; soil moisture and vadose water, 0.0108; biological water, negligible; ground water, 0.5060; and ice-caps and glaciers, 1.9250. Cyclic water, annual precipitation and annual outflow from the land to the sea are also calculated and discussed. With 97 percent of the world's water in oceans and 2 percent in deep freeze, the world is a fine place for whales and penguins, but has its shortcomings for man. With 17 percent of the land area frozen or under ice, and 32 percent being arid, it is small wonder man has sought ways to interfere with the hydrologic cycle. — HRC

08186 **Nace, R. L.** Human use of ground water, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 285-294, illus., 1969.

This is a general survey of the occurrence and exploitation of ground water, starting with the underground tunnels used in antiquity. Since climate has not substantially changed for the last 8,000 years and because of the presence of large volumes of ground water in desert areas where recharge is negligible, the concept of inherited (from former climatic conditions) ground water is discussed. Cyclic ground water, or the relation of motion and use to recharge is important, inasmuch as in some areas the amount of movement is clearly variable and some waters are cycled faster than others. The management of ground water is important in most arid regions and is becoming an important part of less arid areas as population increases. Artificial recharge and pollution are also current problems associated with human use. — HRC

Naeser, C. W. *See* McKee, Edwin H. 00313

Naeser, C. W. *See* Meyer, C. E. 00315

00410 **Naeser, C. W.; Engels, J. C.; Dodge, F. C. W.** Fission track annealing and age determination of epidote minerals: Jour. Geophys. Research, v. 75, no. 8, p. 1579-1584, illus., tables, 1970.

The epidote group of minerals is well suited for age determination by the fission-track method. The minerals occur in a large variety of rock types; fission tracks are readily etched in them; and epidote retains its tracks at high temperatures. No annealing of fission tracks in epidote was detected after 16 days at 600°C, whereas almost all tracks were annealed in 6 hours at 700°C. Extrapolation of the experimentally determined temperatures suggests that a temperature of 630°C would be required for 10^8 years to remove all tracks. Fission-track ages of epidote and allanite agree well with ages of coexisting minerals determined both by fission-track and other methods. — Authors' abstract

08142 **Nagata, Takesi.** Length of geomagnetic polarity intervals [discussion of papers by A. Cox, 1968, 1969]: Jour. Geomagnetism and Geoelectricity, v. 21, no. 3, p. 701-704, illus., 1969.

Although a process which can be described in terms of Bernoulli trials probably is involved in the mechanism of reversals of the geomagnetic polarity, the two basic assumptions in the theory presented by Cox (Jour. Geophys. Research, v. 73, p. 3247, 1968; Science, v. 163, p. 237, 1969), that the main field is represented by a steady dipole oscillator and that a trigger effect takes place whenever the nondipole field varying at random becomes sufficiently large relative to the dipole oscillator, have

not been reasonably justified. Both are unrealistic when viewed from current theoretical knowledge of geomagnetic dynamos. An alternate hypothesis is presented which demonstrates that the average length of geomagnetic polarity intervals is twice as long as the average life length of a stable dipole field or a distorted convection pattern. — VSN

08177 **Nagata, Takesi; Carleton, Barbara J.** Notes on piezo-remanent magnetization of igneous rocks — Pt. 3, Theoretical interpretation of experimental results: Jour. Geomagnetism and Geoelectricity, v. 21, no. 3, p. 623-645, illus., tables, 1969.

Characteristics of the six types of stress-affected remanent magnetization of igneous rocks are theoretically derived for a model rock in which a large number of ferrimagnetic minerals having an isotropic magnetostriction are distributed at random. For small magnetic fields (H) and small uniaxial compressions (P) irreversible displacements of 90° domain walls alone are subjected to a uniaxial compression in the acquisition process of remanent magnetization. Hence, Rayleigh's law of the magnetic hysteresis loop is adopted in examining the effect of H and P on displacement of 90° walls. Theoretical curves fit observed curves reasonably well, having all observed characteristics of respective types of stress-affected remanent magnetization. — *from* Authors' abstract

Nakagawa, H. M. *See* Marranzino, A. P. 00420

Nalwalk, A. J. *See* Hart, S. R. 00477

00322 **Nason, Robert D.** Active slippage on the Buena Vista thrust fault, Taft, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 123, 1970.

00323 **Nason, Robert D.** Fault creep slippage in the street grids of Hollister and Hayward, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 123-124, 1970.

07948 **National Academy of Sciences.** Eutrophication — Causes, consequences, correctives; proceedings of a symposium [1967]: Washington, D.C., Natl. Acad. Sci., 661 p., illus., tables, 1969.

In this International Symposium on Eutrophication, at Madison, Wisconsin, need was seen for: greater knowledge of processes involved; study on the ecosystem basis of lake waters, sediments, and drainage basins; algal studies coupled with experiments in chemical alteration of lake waters, using more sensitive analytical techniques; and concern in beneficial aspects not limited to environmental factors in high production, but favoring efficient conversion of phytoplankton to food. Documented history of lake enrichment, as a basis for timing management programs, may come from advances in paleolimnology or data not yet analyzed from this point of view. Most urgent is prevention of further damage to water resources; ecosystem models suggest reduction in nutrient supply as the only effective control. Various methods are recommended. Ten papers are cited separately in this bibliography. — GDC

07787 **National Research Council** (Committee on the Alaska Earthquake). Toward reduction of losses from earthquakes — Conclusions from the great Alaska earthquake of 1964: Washington, D. C., Natl. Acad. Sci., 34 p., illus., 1969.

This summary of an unpublished comprehensive study, reviews events of the earthquake, gives recommendations of the separate panels of the committee, as well as the principal conclusions of the committee as a whole. In national planning for minimizing losses from future earthquakes, research and regulation are recommended only insofar as they offer a basis for safety factors in structural design, patterns of use and occupance of hazard sites, and for containment of disasters through better education, adequate warning, plans for fighting fire and disorder, for rescue and relief. The committee states that loss-reduction programs should be designed not only for earthquakes but for other environmental hazards as well. A federal task force should be established to set up a comprehensive government program, and states and regional authorities should create their own programs also. — EH

07770 **Neal, J. T.; Cronin, J.; Williams, R. S., Jr.** Satellite monitoring of lakebed surfaces, *in* Satellite imagery of the Earth: Photogramm. Eng., v. 35, no. 7, p. 660-661, illus., 1969.

The usefulness of dry lakebeds as landing sites has been limited by the inability to monitor continuously surface changes due to rain. Satellite photography is a partial solution as reflectance changes indicate soil moisture variation. An AVCS image taken over northwestern Nevada, and a Gemini 4 photo of Willcox Playa, Arizona, are included. — ESL

Neal, J. T. *See* Gawarecki, S. J. 07771

00458 **Neave, K. G.; Savage, J. C.** Icequakes on the Athabasca glacier: Jour. Geophys. Research, v. 75, no. 8, p. 1351-1362, illus., 1970.

Icequakes have been recorded with an eight-geophone array on an active glacier. All the events appear to originate from extensional faulting near the surface of the glacier. The absence of events occurring at depth suggests that creep-instability mechanisms proposed for shear faulting are not operative at depth in the glacier. Most icequakes occurred as single events within the zone of marginal crevasses. Swarms of icequakes were occasionally recorded. The individual events in a swarm were distributed along a straight line several hundred meters long. The activity seemed to progress from one end of this line to the other at a velocity of about 30 mps. The line often extended through a crevasse-free section of the glacier. — Authors' abstract

00324 **Neff, Thomas R.** The Buffalo Mountain pluton dike swarm [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 124, 1970.

00325 **Nehru, C. E.** Morphology and growth trend changes in zircons during metamorphism — A case study from Upper Dripping Spring Formation, Gila County, Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 124-125, 1970.

08025 **Neilson, Frank Murray.** The geometry of stable bed forms under oscillatory flow [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2678B-2679B, 1969.

07885 **Nelson, Gareth J.** Infraorbital bones and their bearing on the phylogeny and geography of osteoglossomorph fishes: Am. Mus. Novitates, no. 2394, 37 p., illus., tables, 1969

The primitive condition of the teleostean infraorbital series probably included seven separate bones from the antorbital to the dermosphenotic. Reduction of both bone and neuromast numbers seems to have occurred during the evolution of most teleostean groups. The primitive condition of seven infraorbital bones occurs in at least some members of all major teleostean groups except the Osteoglossomorpha, which typically have six or fewer bones, resulting from secondary fusion between two of the middle bones. With other evidence, primarily the structure of the caudal fin, this indicates that the Recent Osteoglossomorpha constitute a monophyletic group, and suggests certain interrelationships among the members of that group. Nevertheless, since some interrelationships remain problematical, a satisfactory phyletic classification of the group and a comprehensive theory of their geographic history are not yet attainable. — *from* Author's abstract

Nesbitt, Robert W. *See* Scott, Robert B. 07865

07808 **New England Intercoll. Geol. Conf.; Bird, John M.** (editor). Guidebook for field trips in New York, Massachusetts, and Vermont — 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, sections paged separately, illus., tables, 1969.

This guidebook contains road logs and descriptions of 21 different field trips conducted during the 61st New England Intercollegiate Geological Conference. Three are in Massachusetts, two are in Vermont, and 16 are in New York. Each is cited separately by author. — HRC

00401 **Newcombe, R. B.** Jed B. Maebius (1907-1969): Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 362-363, portrait, 1970.

07912 **Nief, G.** Détermination de la concentration en deuterium des échantillons, *in* Études
GGrönland, v. 177, no. 2, p. 36-42, illus., 1969.

A description is given of a mass spectrometer, built under the author's direction, to measure the concentration of deuterium molecules in hydrogen. Water samples from the Greenland Icecap were analyzed and the results of the analysis are given. Illustrations and a detailed description of the instrument are included. — EH

00431 **Nightingale, Harry I.** Statistical evaluation of salinity and nitrate content and trends beneath urban and agricultural areas, Fresno, California: Ground Water, v. 8, no. 1, p. 22-28, illus., tables, 1970.

The salinity and nitrate content of well water for an urban zone (Fresno-Clovis, Calif.) and the surrounding irrigated agricultural zone were compared using data for 1950 through 1967. Time trends in chemical properties were evaluated statistically by dividing the 18-year period into three 6-year periods. Salinity of the urban zone ground water has increased with time, perhaps related to population; that of the agricultural zone (33 percent more) reflects years of evapotranspiration and recycling of ground water, with fluctuations possibly related to amount of high quality surface water delivered. The nitrate content of well water from both zones has increased with time, water from the agricultural zone showing the greatest increase. Linear and quadratic orthogonal comparisons are tabulated. — GDC

07995 **Nitecki, Matthew H.** Redescription of *Ischadites koenigii* Murchison, 1839: Fieldiana — Geology, v. 16, no. 13, p. 341-359, illus., table, 1969.

This paper is part of a larger study of the revision of North American receptaculitids (dasycladacean algae). The new tribe Receptaculiteae (Ordovician-Devonian), here diagnosed, comprises *Receptaculites* Deshayes, 1929 and *Ischadites* Murchison, 1839. To resolve taxonomic confusion between the two genera, the genotype of the latter, *I. koenigii*, is redescribed, based on the original material from the Silurian of England. Many North American specimens, particularly those from Niagaran rocks, are indistinguishable from the English specimens, and many named species are probably junior synonyms. *Ischadites* is redefined as having a globose thallus with noncalcified main axis, thin laterals borne on tightly packed whorls, lateral heads consisting of four-ribbed stellate structures and facets, encrusting calcification forming a single heavy outer wall. — VMJ

08083 **Nitecki, Matthew H.** Surficial pattern of receptaculitids: Fieldiana — Geology, v. 16, no. 14, p. 361-376, illus., 1969.

Receptaculitids are marine dasycladacean algae of Early Ordovician to early Middle Devonian age comprising three tribes: Cyclocriniteae, Calathieae, and Receptaculiteae, all possessing globoid thallus (conical in Calathieae), with main axis, lateral branches borne in whorls and terminating in expanded calcified heads with proximal stellate structures and facets. The tribes are differentiated by progressive increase in calcification and complexity of lateral head structures. The surface of a well-preserved thallus shows the tops of lateral heads in contact, arranged in regular geometric pattern forming sinusoidal curves; however, most specimens are found without complete lateral heads. A series of diagrams shows geometric arrangements of facetal lines for successive surface levels. — VMJ

Noble, Donald C. *See* Korringa, Marjorie K. 00297

00433 **Noble, Donald C.** Significance of phenocryst resorption for the intratelluric crystallization and eruptive history of silicic pyroclastic rocks [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 125, 1970.

00326 **Nokleberg, Warren J.** Multiple folding in the Strawberry mine roof pendant, central Sierra Nevada, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 125-126, 1970.

Nordstrom, Charles E. *See* Peterson, Gary L. 00460

07822 **Norton, Stephen.** Unconformities at the northern end of the Berkshire Highlands, Trip 21 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 21-1 — 21-20, illus., 1969.

A 20-mile field trip with 10 stops examines the Precambrian-Ordovician rocks in the Windsor quadrangle. A metamorphic discontinuity between the Precambrian and Paleozoic rocks occurs as does a great structural and stratigraphic difference. The Hoosac nappe contains Paleozoic rocks and is a product of Acadian tectonism. The understanding of the Cambrian rocks in the area bears on the problems of shortening of the crust during the tectonism. The Middle Ordovician Berkshire Schist rests unconformably upon many different older formations and was apparently deposited as a clastic unit at the time that the area now underlain by Precambrian rocks was emergent. — HRC

Nowroozi, Ali A. *See* Seeber, Leonardo. 07828

Nur, Amos. *See* Aki, Keiiti. 00219

Nuttli, Otto W. *See* Followill, Fred E. 00265

07833 **Nuttli, Otto W.** Ground motion and magnitude relations for central U. S. earthquakes [abs.]: Earthquake Notes, v. 40, no. 4, p. 14, 1969.

07837 **Nuttli, Otto W.; Stauder, William; Kisslinger, Carl.** Travel-time tables for earthquakes in the central United States: Earthquake Notes, v. 40, no. 4, p. 19-28, illus., table, 1969.

Traveltime tables for earthquakes occurring in the central United States and recorded in central and eastern North America are presented for distances from 0 to 1000 km. The tables are given for focal depths of 0, 5, 15, 25, and 35 km. — Authors' abstract

08018 **O'Brien, Neal R.; Suito, Eiji.** Comparison of the fabric of a sensitive Pleistocene clay with laboratory flocculated clay using the scanning electron microscope: Maritime Sediments, v. 5, no. 2, p. 58-61, illus., 1969.

The clay studied is found at water level 600 feet downstream from Snell Lock on the St. Lawrence River, near Massena, New York. Its properties are similar to "Leda" clay of the St. Lawrence and Ottawa River valleys. Although the sample was air-dried, the random flake orientation was apparent and little different from freeze-dried clay. There seems little doubt that this cardhouse structure is produced in flocculated clay deposited in marine water. Experiments with a poorly crystalline kaolinite in distilled water indicate that this state could be produced also by deposition of a high clay concentration in fresh water. In the laboratory, flocculation was due not to the presence of electrolites but the high clay concentration. Freeze-dried, the fabric had open structure of parallel flakes in packets with random orientation, similar to flake orientation in the Pleistocene clay. — GDC

07849 **O'Brien, Philip J.** Hydrogeology and remote sensing of the Mohawk River valley near Schenectady, New York, Trip 8 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 8-1 — 8-19, illus., tables, 1969.

A one-day field trip of 22 miles makes 8 stops, begins at Albany, and ends nearby. The objective of the trip is to (1) see deposits in the field which are capable of producing a major ground water supply to the city of Schenectady-Rotterdam, (2) examine the distribution of the unconsolidated deposits associated with the aquifer, (3) outline geographically the boundaries of the aquifer system, (4) visit the Schenectady pumping facility, (5) examine the cone of depression associated with the Schenectady-Rotterdam pumpage and aquifer, (6) demonstrate effects produced

by surface structures (locks on barge canal) such as surface recharge to aquifer from differing flows in the river level, and (7) examine infrared imagery and radiometer data of the area. — *from* Author's introduction

O'Connor, J. J. *See* Armington, A. F. 00446

08148 **Odegard, Mark E.; Mark, Norman; Letourneau, Nelson J.; Kwon, Tai H.** Ocean Bottom Seismographic Station (OBS) catalogue of events for the period 1 Feb 1967 to 31 Jan 1968 — U. S. Air Force Contract F19628-68-C-0083, Sci. Rept. 1: Hawaii Inst. Geophysics Rept. HIG-69-18 (Data Rept. 13)(AFCRL-69-0452), 46 p., illus., table, 1969.

This is a catalog of events recorded by the Columbia University Ocean-Bottom Seismographic Station (OBS III) located off Point Arena, California, at a water depth of 3.9 km. The list of events gives the date, time of arrival, phase identification, recording component, and, where possible, a description of the cause of the disturbance. Most disturbances are the result of earthquakes in various parts of the world. Instruments used include long-period and short-period seismometers, coil hydrophone, and crystal hydrophone. — GDC

08179 **Oesch, Ronald D.** Fossil Felidae and Machairondontidae from two Missouri caves: Jour. Mammalogy, v. 50, no. 2, p. 367-368, 1969.

Remains of Pleistocene jaguars and a sabertooth cat have been found in two karst caves in Perry County. A canine tooth of *Smilodon* sp. was found in a gravel bar in an intermittent stream in Crevice Cave, associated with several other mammals. Measurements are within the ranges for *S. californicus* but certain identification cannot be made. This is the first report of the species in the state. A partial left mandible, found upstream from the *Smilodon* site, was referred to *Felis onca augusta*. The mandibles of Pleistocene jaguars from Crevice Cave are compared with those from Craighead Caverns, Tenn., and Longhorn Caverns, Tex. In Berome Moore Cave, Mo., a partial mandible of *F. onca* was found. Hundreds of footprints of a large feline are found in the mud floor of this cave, some covered by travertine; measurements are given. — ESL

Oeschger, H. *See* Aegerter, S. 07915

07918 **Oeschger, H.; Roth, E.** Schlussbemerkungen, *in* Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, p. 111-113, 1969.

The results of research on stable and radioactive isotopes during the International Glaciological Expedition to Greenland, 1957-1960, included: detection of Pb-210 for the first time in glacial samples; data on correlation of D/H and O-18/O-16 isotope ratios and on relation between temperature and O or H isotope content; indications, from stratigraphy, of climatic changes during the last 50 years; estimates of tritium deposition on the icecap and of global tritium production; influence of solar activity on tritium deposition; and analysis of gas composition of ice samples in the region of ablation. Further research is recommended on: the accumulation rate since 1953 at all stations, using tritium analysis; establishment of a complete stratigraphic profile and a time scale; techniques for obtaining uncontaminated samples from greater depths; correlation of tritium or Pb-210 concentration with solar activity; and effect of meteorological or cosmic phenomena on tritium deposition rate. — EH

Oeschger, H. *See* Lindt-Muehlemann, C. 08068

07986 **Ogg, James H.** Trona — Sweetwater County, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 183-184, 1969.

This is a summary of the trona industry in the state. In 1969 there were 3 producing mines in the county. All surface facilities are north of Interstate 80; those south of the route are not yet developed. A summary of the current lease-holders and current

research are given. All of the trona production is from 2 beds, although over 25 beds are known in the area. — HRC

07953 **Oglesby, R. T.** Effects of controlled nutrient dilution on the eutrophication of a lake, *in* Eutrophication — Causes, consequences, correctives — Symposium [1967], Proc.: Washington, D.C., Natl. Acad. Sci., p. 483-493, illus., tables, 1969.

In 1959 a unique approach was proposed to combat eutrophication of Green Lake, Seattle, Wash., by dilution; first flushing from surplus city water supply was made in 1962. Since Jan. 1965 a limnological study has been in progress to evaluate the efficacy of this program. Comparison of data collected in 1965-67 with those obtained in 1959 indicates that substantial changes in water quality have followed the addition of dilution water. This is illustrated in diagrams for variations in phosphorus, nitrogen, transparency, chlorophyll, and composition of phytoplankton taxa. Characteristics typical of a eutrophic lake in 1959 showed in a significantly lower degree in 1965-66. Climatic differences which might have been a factor were insignificant. It is unlikely that trace elements became limiting for algal growth; reduction in algae could be the result of washout. — GDC

00327 **Ohta, Yutaka; Asada, Tetsutaro.** Strong-motion observation system with a wide amplitude range — Pt. 1, Construction of headquarters station [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 126, 1970.

00328 **Oliver, H. W.; Hanna, W. F.** Structural significance of gravity and magnetic meganomalies in central California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 126-127, 1970.

08009 **Oliver, Jack; Johnson, Tracy; Dorman, James.** Postglacial faulting and seismicity in New York and Quebec [abs.]: Earthquake Notes, v. 40, no. 4, p. 9, 1969.

00329 **Olson, G. H.; Larson, E. R.** Differentiation of Lake Lahontan sediments in western Nevada by grain size distribution [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 127, 1970.

00331 **Olson, Robert C.** A major thrust fault in the northwestern Inyo Mountains, Inyo County, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 128, 1970.

Ondrick, C. W. *See* Griffiths, J. C. 07902

00330 **Orme, Antony R.; Howard, Robert B.; Welde, David L.** Stream channel geometry and coarse sediment morphometry as measures of debris production and erosion in small drainage basins — A test case [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 128, 1970.

Oró, J. *See* Simmonds, P. G. 08056

Orphal, D. L. *See* Lahoud, J. A. 00301

Ozawa, Toru. *See* Ito, Tei-ichi. 08081

00332 **Page, Ben M.** Time of completion of underthrusting, Franciscan vs. Great Valley rocks, Santa Lucia Range, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 129, 1970.

07798 **Page, Leo M.; Wire, Jeremy C.** How geology serves the water needs of an instant metropolis — Northern Santa Clara Valley, *in* Urban environmental geology in the San Francisco Bay region (E. A. Danehy and R. C. Harding, editors): Sacramento, Calif., Assoc. Eng. Geologists, p. 105-124, illus., tables, 1969.

The main functions of geologists were regional studies of geology, ground water conditions, and engineering geology of major dam sites. A summary of the generalized geological setting, and a summary of the physiography, climate, and surface water

conditions are included. There is a direct relation between the ground-water regime and the geologic setting, as the different units contain and distribute the water in different and distinct ways. Ground-water recharge and withdrawal are important in the region, as salt water intrusion into the shallow aquifers has occurred. In addition to water supply problems, rapidly diversifying and expanding urban land use is also affecting management of the ground water basin in the northern Santa Clara Valley. — HRC

Palmquist, Robert C. *See* Foster, John D. 08114

07816 **Park, Richard A.; Fisher, Donald W.** Paleoecology and stratigraphy of the Ordovician carbonates, Mohawk Valley, New York, Trip 14 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 14-1 — 14-16, illus., 1969.

The use of Sorensen's coefficient in analyzing fossil suites from the Glens Falls and Amsterdam limestones has resulted in the recognition of two biotopes representing muddy and clear water environments. The former consists primarily of trilobite and ectoproct biofacies and the latter of brachiopid, echinoderm, and gastropod biofacies. The interpretations are based primarily on functional morphology of the organisms and to a lesser extent on the lithologic associations. In general, the Amsterdam and lower Glens Falls (Larrabee Limestone) represent dominantly clear water, high-energy, subtidal to intratidal biotopes and the upper Glens Falls (Sugar River Limestone) is dominated by muddy, lower-energy, subtidal and supratidal biotopes but with intercalated clear water beds. Five field trip stops are described in detail. — HRC

00443 **Parks, James M.** Computerized trigonometric solution for finding original dip azimuth and inclination of cross-beds in plunging folded strata [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 1, p. 31, 1970.

07763 **Parry, J. T.; Cowan, W. R.; Heginbottom, J. A.** Soils studies using color photos: Photogramm. Eng., v. 35, no. 1, p. 44-56, illus., table, 1969.

Air photo interpretation and field survey of exposures of bare soils in the Lac Bevin basin, Quebec, varying in texture from clay to sandy loam, demonstrated the superiority of color photography (Aerial Ektachrome) over panchromatic in identifying and plotting soil boundaries, in differentiating soil types within a series, and in distinguishing variations of moisture and organic content. Exact correspondence between field and photo colors as defined in the Munsell system was not obtained, and it was found that very few soils provided a unique color signature at either the soil series level (USDA) or the USCS group level. However, a greater degree of differentiation between soil types was possible with color photos compared with the panchromatic as the color image provided more varied stimuli to the interpreter. — Authors' abstract

Parry, W. T. *See* Bates, T. R. 00429

08102 **Parsons, Willard H.** Criteria for the recognition of volcanic breccias — Review, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 263-304, illus., 1969.

Criteria for recognizing different types of pyroclastic and related rocks, especially breccias, in the vent or cone-complex facies of volcanic provinces are reviewed. These criteria include structural features, character of the fragments, and the composition and texture of the groundmass of the volcanics. Autobrecciation, underground brecciation, pyroclastic flows (nuées ardentes), volcanic mudflows (lahars), explosive ejection of tephra, and subaqueous breccia flow deposits are discussed. — HRC

07802 **Patchen, Douglas G.** Geology and drilling history of the Newburg Sand in West Virginia, *in* Kentucky Oil and Gas Assoc., 32d Ann. Mtg., 1968, Proc. Tech. Sess.: Kentucky Geol. Survey Spec. Pub. 17, p. 26-41, illus., 1969.

The Newburg sand (Upper Silurian Williamsport Sandstone) is a thin, extensive sandstone present in the subsurface under most of West Virginia. It generally is a light gray or white to brown, very fine-grained clean sandstone, composed mainly of rounded quartz grains with carbonate cement. During the past 3 years the Newburg has become the principal target for deep gas drillers in West Virginia. Three gas fields have been developed and are being extended. More than 100 gas wells have been completed in this new pay to date, with an average initial flow of 14,660 Mcf per well. A recent wildcat in Jackson County discovered oil as well as gas in the Newburg. Statistics are current through May 10, 1968. — Author's abstract

07790 **Paterson, W. S. B.** The physics of glaciers: London and New York, Pergamon Press, 250 p., illus., tables, 1969.

The aim of this book is to explain the physical principles underlying behavior of glaciers and ice sheets in the light of present knowledge. Intended primarily for those starting research in glaciers, the book should be useful for experienced workers also; the treatment is about at the graduate student level. Chapter headings are: introduction, transformation of snow and ice, mass balance of a glacier, energy exchange at a glacier surface, measurements relating to glacier flow, glacier flow (ice deformation and basal sliding), glacier surges, flow of ice sheets, distribution of temperature in glaciers and ice sheets, response of a glacier to changes in mass balance, and glaciers and climate. A six-page bibliography, and subject and geographic indexes are appended. — MCM

Payne, C. Marshall. *See* Proctor, R. J. 00428

07807 **Pearl, Richard M.** 1001 questions answered about earth science (revised edition): New York, Dodd, Mead and Co., 327 p., illus., 1969; originally published 1962.

Most frequently asked questions about earth science are categorized as follows: turn of time, pageant of life, when life began, vanished forests, ancient invertebrates, age of fishes and amphibians, medieval monsters, extinct beasts of the Tertiary, ice age zoo, work of glaciers, climates of the past, patterns of land and sea, waters under the earth, cycle of streams, shifting sands, birth and death of volcanoes, our quaking earth, architecture of the crust, landscapes in four dimensions, and the face of America. An index and a bibliography are appended. — MCM

Pedersen, E. J. *See* Franzmeier, D. P. 07863

Pelker, P. *See* Hughes, B. 07913

07898 **Pelkert, E. W.** Developments at the man-machine interface, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 1-11, illus., 1969.

The linguistic barrier between geologist and the computer can be more readily solved than heretofore appreciated, by the use of computer graphics. With a light pen on a series of graphic displays, the geologist can select and edit data, build a numerical representation of the data, apply a variety of numerical models, and display results in the form of contour maps, cross sections, perspective displays, and etc. The computer is used to perform tedious tasks of information retrieval, numerical computation, and generation of displays; the geologist makes judgments on validity of data and applicability of a variety of numerical techniques for data enhancement as well as to determine the best set of displays for hard copy, high resolution plotting, and subsequent interpretation — all in considerably reducted time. — *from* Author's abstract

Pering, Katherine. *See* Ponnamperuma, Cyril. 07997

00333 **Perkins, Michael E.** Upper Cretaceous marine conglomerates in the central Coast Ranges, California — Source area and transport mechanism [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 129-130, 1970.

00475 **Persse, Franklin H.** Bismuth in the United States: U. S. Bur. Mines Inf. Circ. 8439, 26 p., illus., tables, 1970.

Imports account for about 75 percent of the bismuth consumed by the United States. Domestic bismuth is recovered chiefly as a byproduct in the mining of copper, lead, and zinc ores, and potential domestic reserves from this source are estimated to be 36.3 million pounds. Another 1.5 million pounds of recoverable bismuth occurs in domestic tungsten reserves. By 1980, domestic deposits are expected to supply 1.3 million pounds of the estimated 3.5 million pounds required annually. Barring development of other domestic sources, the proportion imported will reach 80 to 85 percent of requirements in the year 2000. — PBM

00334 **Pessagno, Emile A., Jr.** The biostratigraphic potential of radiolaria in the upper Cretaceous portion of the Great Valley sequence, California Coast Ranges [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 130, 1970.

07992 **Pessagno, Emile A., Jr.** The potential of Radiolaria in Mesozoic deep sea stratigraphy [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 173-174, 1969.

00335 **Pestrong, Raymond.** Processes of sedimentation in San Francisco Bay [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 130-131, 1970.

07768 **Pestrong, Raymond.** Multiband photos for a tidal marsh: Photogramm. Eng., v. 35, no. 5, p. 453-470, illus., tables, 1969.

A variety of multiband imagery including nine-lens in the 400-900 millimicron range, panchromatic, Ektachrome, and Ektachrome-Infrared photography, has been obtained for a tidelands area in San Francisco Bay. A technique for comparing their relative utility for specific geomorphic interpretations has been developed, whereby a subjective form of tracing analysis may be correlated with a more objective (and quantitative) scheme of selected microdensitometer traverses across the negatives and positive transparencies. Results suggest that nine-lens multiband imagery is excessive, and, for a similar use, could be reduced to four-lens imagery. The most useful frames are the 550-630 m millimicron bandwidth, near-infrared, and Ektachrome color and Ektachrome-Infrared transparencies. Various utilities are suggested for each type of imagery, and increased experimentation with the microdensitometer is urged. — *from* Author's abstract

Peterson, David H. *See* Carlson, Paul R. 00241

Peterson, David H. *See* Conomos, T. John. 00247

Peterson, Etta. *See* Kvenvolden, Keith A. 00300

00336 **Peterson, Gary L.** Pleistocene deformation of the Lina Vista terrace near San Diego, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 131, 1970.

00460 **Peterson, Gary L.; Nordstrom, Charles E.** Sub-La Jolla unconformity in vicinity of San Diego, California: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 265-274, illus., 1970.

In the San Diego area, flat-lying Upper Cretaceous and Cenozoic sedimentary rock units rest unconformably on deformed late Mesozoic igneous and metamorphic basement rocks. Relief on basement rocks exceeds thickness of sedimentary cover and hills of basement rock locally protrude. Upper Cretaceous marine Rosario Formation rests unconformably on sub-Rosario basal conglomerates, and the Eocene La Jolla Formation unconformably overlies the Rosario. New studies of facies of these rock units indicate post-Rosario uplift, erosion, and deposition of La Jolla on either of the Cretaceous rock units, or on basement rocks. — BHK

08117 **Peterson, Ronald M.; Vondra, Carl F.** The St. Louis Limestone, Cook's Quarry, *in* The many faces of geology — Tri-State [Geol.] Field Conf., 33d, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, p. 68, 1969.

This article describes four regional facies of the Late Valmeyran St. Louis Limestone from a section in Cook's Quarry in central Iowa. — EH

07937 **Pickett, T. E.; Ingram, R. L.** The modern sediments of Pamlico Sound, North Carolina: Southeastern Geology, v. 11, no. 2, p. 53-83, illus., table, 1969.

It is apparent that there are reproducible relationships between the physical properties of sediments and their environments of deposition in Pamlico Sound. These relationships are shown best by preparing facies maps from data derived from the megascopic examination of sediment samples and from the study of structures in shallow cores. The sedimentary relationships delineated in Pamlico Sound should be at least partially applicable to similar ancient sediments. The Sound can be divided into eleven environments of deposition, each recognized by characteristic lithology: Barrier island, central basin, cross lagoon shoal, finger shoal, inlet, lagoonal beach, lagoon near narrows, lagoon near river mouth, mainland marsh, marginal lagoon, protected mainland embayment. Water depth, sediment source and wave and current action are the dominant factors controlling sediment distribution. — *from* Authors' conclusions

Pipiringos, G. N. *See* Denson, N. M. 07969

00337 **Piwinskii, A. J.** Experimental investigation bearing on the petrogenesis of the Coast Range and Sierra Nevada plutonic belts [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 131-132, 1970.

07819 **Platt, Lucian B.** Some aspects of conglomerates in the Taconics, Cossayuna area, New York, Trip 18 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 18-1 — 18-11, 1969.

A field trip of 39 miles makes six stops in the Cossayuna area. Conglomerates are examined with a view toward studying the relations between the sedimentary and structural features with the tectonic setting during formation. Both allochthon and autochthon are examined. The Taconic sequence was deposited between a carbonate-quartzite sequence on the west flank of what is now the Green Mountains and a shaly and volcanic sequence on the east. The total thickness is about 3,000 feet, thinner than theother surrounding sequences. The Taconic sequence was deposited on a slope sufficiently gentle and deep to permit settling of clay-sized material but sufficiently inclined to cause progressive sliding and slumping and general attenuation of the section. — HRC

08036 **Plummer, Charles Carlton.** Geology of the crystalline rocks, Chiwaukum Mountains and vicinity, Washington Cascades [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2762B, 1969.

Plummer, Gayther L. *See* Ritchie, Jerry C. 08082

07847 **Pocock, Stanley A. J.; Jansonius, Jan.** Redescription of some fossil gymnospermous pollen (*Chasmatosporites*, *Marsupipollenites*, *Ovalipollis*): Canadian Jour. Botany, v. 47, no. 1, p. 155-165, illus., 1969.

New morphological details of the monosulcoid form genera *Chasmatosporites*, *Marsupipollenites*, and *Ovalipollis* are given. Systematic descriptions include emendations of *Chasmatosporites*, *Ovalipollis*, and several species assigned to these genera. Possible phylogenetic relationships and paleobotanical affinities are discussed. — Authors' abstract

08054 **Podmaroff, P.** The application of computer techniques to exploration for oil and gas: Inst. Petroleum Jour., v. 55, no. 541, p. 14-21, illus., 1969.

Storage systems in use include basic well data, the basic working tool that is more useful if divided into categories linked together by well locations. Files should be updated frequently, and all data edited extensively. Report generation is a useful application of computer techniques, allowing the exploration man to occupy his time using data rather than preparing it. Greatest value of computer techniques to the geologist is retrieving data, manipulating information, and preparing maps. Map posting by computer is accurate and eliminates many hours of work. Map contouring

has extensive applications but it is difficult to program a computer to contour anomalies such as those over faults. Other techniques are trend-surface analysis and compilation of graphs. Operating personnel, by learning to use simple techniques, will develop and improve these new applications until they become routine. — ESL

07997 **Ponnamperuma, Cyril; Kvenvolden, Keith; Pering, Katherine.** Organic geochemistry and the origin of life [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 180, 1969.

08013 **Ponomarenko, A. G.** Cretaceous insects from Labrador — [Pt.] 4, A new family of beetles (Coleoptera: Archostemata): Psyche, v. 76, no. 3, p. 306-310, illus., 1969.

The collection of beetles studied is of early Cenomanian or very late Albian age, and consists of eight elytra. Four have preserved the furrow structure common in water beetles. Two others have longitudinal striae, also very common, but one resembles *Peltodytes*. The two remaining belong to the Archostemata, one representing a new family, here named Labradorocoleidae, based on the new genus *Labradorocoleus*, including the single species *L. carpenteri*. The labradorocoleids arose from a tschekardocoleoid branch of archostemate beetles. — ESL

Poodle, Thomas. *See* Fleming, George. 00440

Poole, Forrest G. *See* Sandberg, Charles A. 00353

07815 **Potter, Donald B.; Lane, Michael A.** Some major structural features of the Taconic allochthon in the Hoosick Falls area, New York-Vermont, Trip 12 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 12-1 — 12-23, illus., 1969.

Seven stops on a field trip of sixty miles are described in detail. Two major thrust sheets comprise the eastern part of the Taconic allochthon in this area. Some of the thrust contacts and the recumbently-folded nature of the base of the lower contact are examined in detail. The Middle Ordovician submarine slide breccia with giant clasts immediately below the allochthon is examined also. All of the stops are in the Hoosick 15-minute quadrangle, and the quadrangles into which it has been subdivided. The two major thrust sheets are the North Petersburg below and the Rensselaer Plateau above. — HRD

07921 **Potter, R. R.; Ruitenberg, A. A.; Davies, J. L.** Mineral exploration in New Brunswick in 1968: Canadian Mining Jour., v. 90, no. 4, p. 68-73, illus., 1969.

The great variety of mineral deposits reflects the long and complex geologic history of this part of the folded Appalachians. Six major mineral zones have been delineated: Kedgwick; Matapedia-Aroostook; Tobique North and South; Miramichi North, South, and Southeast; Kennebecasis West and East; and Central Basin. Each contains one or more different types of deposits. Zones and deposits are described. — ESL

08051 **Pouquet, Jean.** Géomorphologie et ére spatiale [with German and English summ.]: Zeitschr. Geomorphologie, new ser., v. 13, no. 4, p. 414-471, illus., tables, 1969.

Description of a few technical aspects of satellite equipment in the Space era emphasizes the High Resolution Infrared Radiometer. Its daytime measurements are not compatible with the needs of geomorphology, mainly because of differences in local times, but at night it can depict heat capacity of formations, differentiating one from another; so it is possible, from a satellite, to detect soil moisture, tectonic features, and former hydrographic patterns. In studies of the Nile Delta and the arid southwestern United States, it has been possible to reconstruct former routes of the Nile River, and of the Colorado and Amargosa Rivers; also to shed new light on geomorphologic evolution of southern California, western margins of Nevada, and Arizona, accenting recent faulting processes. In the three categorized valleys, undisturbed ones might be cultivated with a minimum volume of water; with rejuvenation, possibilities of water retention decrease. — GDC

07989 **Powell, A. W.; Schumann, T. G.** First day of field conference, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 212-217, illus., 1969.

This field trip is 123 miles long and makes 5 stops, beginning in Casper and ending near Moneta. Descriptions of geology en route and at stops are given. The regional structure and stratigraphy are described from Hell's Half Acre; another stop is at the Waltman Member type section. A stop at old Badwater post office is used to discuss the complex Tertiary structures, and the fourth stop is in the upturned beds of the Fort Union Formation overlain by the Lysite Member of the Wind River Formation. The last stop, in the Moneta Hills, is in the oil and gas fields area. — HRC

Pray, Lloyd C. *See* Choquette, Philip W. 00405

08168 **Prest, V. K.; Grant, D. R.** Retreat of the last ice sheet from the Maritime Provinces-Gulf of St. Lawrence region: Canada Geol. Survey Paper 69-33, 15 p., illus., 1969.

The popular concept of overriding Laurentide ice (Labradorean sector) is found wanting in this region. Reinterpretation of glacial lineations and other features indicates localized, radial outflow from certain uplands and lowlands. The pattern of ice-flow features and end moraines is related to a rising sea level during the years 18,000 to 11,000 B.P., to active parts of an Appalachian ice complex as the sea encroached on depressed land masses, and to deeper-water coastal leads into ice fronts, resulting in calving bays and ice drawdown. Growth of Appalachian glaciers during buildup of the last continental ice sheet may have effectively barred Laurentide ice from some parts of the region; a Laurentian Channel outlet diverted it through Cabot Strait to the Atlantic Ocean. Prince Edward and Cape Breton Islands show no pattern of Laurentide ice flow; the Magdalen Islands remained unglaciated. — *from* Authors' abstract

Price, Don. *See* Bolke, E. L. 07887

Price, Don. *See* Hood, J. W. 07893

07890 **Price, Larry W.** The collapse of solifluction lobes as a factor in vegetating blockfields [with French and Russian abs.]: Arctic, v. 22, no. 4, p. 395-402, illus., 1969.

The development of soil and vegetation in blockfields through normal processes is very slow. It is surprising, therefore, to find in the Ruby Mountains of southwest Yukon Territory, tongues and islands of vegetation occurring amidst certain blockfields. The collapse of solifluction lobes from upslope is suggested as the mechanism responsible. The lobes pass from the more gentle solifluction slope of the alb onto the steeper slope of the blockfields, and eventually become unable to maintain themselves because of: steeper slope, change in composition of vegetation, and deeper active layer. Once the lobes do collapse, they flow downslope carrying with them clumps of vegetation which may become established somewhere along the mud-flow channel or levee. In this way, small outposts of vegetation are created and speed up a process which would otherwise take indeterminately longer. — Author's abstract

07870 **Price, Vaneaton, Jr.; Stratton, Lewis P.; Leitner, Charlotte.** The role of sulfide producing bacteria in the control of trace metal concentrations in ground water [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 183, 1969; Econ. Geology, v. 64, no. 7, p. 832, 1969.

Prinz, Martin. *See* Larsen, Leonard H. 07955

Prinz, Martin. *See* Larsen, Leonard H. 07956

Prior, J. W. *See* Kennedy, E. G. 07925

00428 **Proctor, R. J.; Payne, C. Marshall; Kalin, D. C.** Crossing the Sierra Madre fault zone in the Glendora tunnel, San Gabriel Mountains, California: Eng. Geology, v. 4, no. 1, p. 5-63, illus., geol. maps, 1970.

An excellent opportunity to study well exposed sections across a major fault zone came with construction in 1966 of the 6.2 mile Glendora water tunnel, southern California. The Sierra Madre fault zone, about 520 feet thick, runs 55 feet along the steep front of the San Gabriel Mountains. Within it are oil-stained, brecciated Miocene shale of the Puente Formation and fault slivers of Precambrian gneiss and Cretaceous quartz-rich granite, thrust at least 700 feet over Quaternary terrace deposits. Geologic mapping and core-hole data proved a longer tunnel route to be much cheaper to build, because of poor rock conditions along the shortest route. Construction was not affected by fault materials,but by bentonite shales adjacent to the fault zone. From core borings the nature of the fault zone was predicted because of an unusual drill-log sequence showing terrace gravels 370 feet beneath the gneiss and granite "basement" rocks. — *from* Authors' summary

Prokopovich, N. P. *See* Swain, F. M. 08178

00338 **Prokopovich, Nikola P.** Hydrocompaction near San Luis Canal, west-central San Joaquin Valley, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 132, 1970.

Prostka, Harold J. *See* Lipman, Peter W. 00306

07866 **Puffer, John H.** Biotite from Colorado granite and its water fugacity of formation [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 183-184, 1969.

07776 **Pulpan, H.** A complex variable technique for the stress field around an elliptic underground inhomogeneity: Pure and Appl. Geophysics, v. 76, p. 137-146, illus., 1969.

The technique of complex variables is used to obtain the solution for the two dimensional elastostatic problem of an elliptic inclusion, subject to an uniform stress field at infinity. It is required that the displacements are continuous and the stresses balance each other across the interface between the inclusion and the surrounding medium. The solution is general in that it can be used for any required shape of the ellipse representing the inclusion and for any arbitrary choice of the elastic parameters of the inclusion and the medium. — Author's summary

07775 **Pulpan, Hans; Scheidegger, Adrian E.** Compressional angles of isallo stress theory for a circular-cylindrical, spherical and elliptic-cylindrical elastic inhomogeneity in an elastic medium: Pure and Appl. Geophysics, v. 76, p. 147-152, illus., tables, 1969.

The compressional angle of isallo stress theory for the case of a cylindrical (circular and elliptic) and spherical subsurface inhomogeneity, assuming that the conjugate fracture surfaces are inclined at a Mohr angle of 30° toward the largest compression, has been calculated. The solution for a spherical and cylindrical inclusion in an infinite medium subject to a uniform stress field (at infinity) were taken as the basis for the stress analysis. The stress angle was then calculated for the mentioned types of inclusions. — Authors' summary

08037 **Qutub, Musa Yacub.** The objectives of the Earth Science Curriculum Project — An evaluation of their achievement [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2763B, 1969.

00339 **Ragan, Donal H.; Sheridan, Michael F.** The Archean rocks of the Grand Canyon, Arizona [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 132-133, 1970.

08003 **Ramanujam, C. G. K.; Stewart, Wilson N.** Nomenclatural changes for *Taxodioxylon antiquum* Ramanujam and Stewart and *T. antiquum* Prakash: Canadian Jour. Botany, v. 47, no. 8, p. 1333-1334, 1969.

Taxodioxylon antiquum Ramanujam and Stewart (ibid., no. 1, p. 115-124, 1969) is renamed as *T. multiseriatum* nom. nov. *Taxodioxylon antiquum* Prakash (1968) is considered to be a later synonym of *T. gypsaceum* (Goppert) Krausel (1949). — Author's abstract

07927 **Rana, M. H.; Bullock, W. D.** The design of open pit mine slopes: Canadian Mining Jour., v. 90, no. 8, p. 58-62, illus., table, 1969.

A system of slope design developed for mines operating in Canada's subarctic, where climatic conditions exert considerable influence, is presented. Actual slope failures in two mines at Schefferville, Quebec, are analyzed. The rocks involved belong to a late Precambrian complexly folded and faulted geosynclinal sequence of sediments and volcanics forming the Labrador trough. Iron orebodies occur in structural troughs, so that Ruth Schist and Wishart Quartzite are exposed in the walls of all pits and are significant in slope stability. Samples were subjected to triaxial tests and results are tabulated; field investigations were also run. Potential failure planes were delineated for different slope angles; from these, critical slope curves were worked out, which were modified to slope design curves. Work is under way on computer application to this procedure. — ESL

00409 **Randall, M. J.** Toroidal free oscillations by the method of factorization: Jour. Geophys. Research, v. 75, no. 8, p. 1571-1572, 1970.

The eigenvalue problem for the toroidal free oscillations of the Earth may be reduced to a single first-order differential equation, which is really integrated numerically even at large wave numbers, with arbitrary radial variation of the model parameters. The technique seems particularly suited to inclusive programs for Earth model inversion which incorporate data from body waves, surface waves, and free oscillations. — Author's abstract

07868 **Ranney, R. W.** An organic carbon-organic matter conversion equation for Pennsylvania surface soils: Soil Sci. Soc. America Proc., v. 33, no. 5, p. 809-811, illus., 1969.

Low temperature ashing was used to determine the organic matter content of soils by weight loss. This technique utilizes oxygen excited by radiofrequency energy to effect oxidation at relatively low temperatures. Ashing at 375°C was used for samples high in organic matter. Corrections were applied for weight loss of inorganic constituents and for incomplete oxidation of organic matter. The following regression equation was developed to convert organic carbon percent to organic matter percent in Pennsylvania surface soils: percent organic matter = $0.35 + 1.80 \times$ percent organic carbon. — Author's abstract

00479 **Rashid, M. A.; King, L. H.** Major oxygen-containing functional groups present in humic and fulvic acid fractions isolated from contrasting marine environments: Geochim. et Cosmochim. Acta, v. 34, no. 2, p. 193-201, tables, 1970.

The major oxygen-containing functional groups present on various fractions of humic and fulvic acids extracted from different marine clays are carboxyls, phenolic and alcoholic hydroxyls and carbonyls. The total acidity of the different fractions ranges from 2 to 7 m-equiv./g of organic matter and appears to arise mainly from carboxyl groups rather than phenolic hydroxyls. The depositional environment is probably conducive to the accumulation and preservation of the carbonyl groups. The oxygen content of an overlying water column does not appear to exercise much influence on diagenetic changes in the organic matter associated with clays, as no appreciable differences were noticed in the functional group content and elemental analyses of organic matter from reducing and nonreducing environments. — Authors' abstract

07881 **Rashid, M. A.** Contribution of humic substances to the cation exchange capacity of different marine sediments: Maritime Sediments, v. 5, no. 2, p. 44-50, tables, 1969.

Composition and properties of humic substances in marine sediments have been studied, but little is known about the nature of association of organic matter with inorganic substrate. Soil scientists recognize that clay minerals and silt fraction carry a net negative charge around edges of silica-alumina units; these inorganic constituents participate in the cation exchange reaction. Humic matter of marine origin can also participate in such reactions, influencing movement and accumulation of various metals in bottom sediments. In investigations of humic substances in samples from Nova Scotia lagoons and shelf, and Cariaco trench off eastern Venezuela, an attempt

is made to characterize cation exchange capacity in relation to associated inorganic constituents in the zone of sedimentation. Contribution of clay minerals ranged from 0.32 to 0.95 meq per gram, depending on relative abundance particularly of montmorillonite. – GDC

07809 **Ratcliffe, Nicholas M.** Structural and stratigraphic relations along the Precambrian front in southwestern Massachusetts, Trip 1 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 1-1 — 1-21, illus., 1969.

At the latitude of Stockbridge, Mass., the Berkshire Highlands make an abrupt swing to the west in a large bulge of rock known as Beartown Mountain where the Precambrian front is offset 5 miles to the west and the map distribution of the Cambrian is drastically altered. A one-day field trip of 30.5 miles makes 8 stops; discussions at each of the stops are given. The Tyringham Gneiss, Washington Gneiss, and hornblende and biotite gneiss of Precambrian age; the Dalton Formation of late Precambrian or Cambrian age; the Cheshire Quartzite and Stockbridge Formation of Cambrian age; and Walloomsac Formations of Ordovician age are described. The Beartown Mountain slice is only one of a series of low-angled thrust faults now known, and its root zone is not yet known. — HRC

07850 **Ratcliffe, Nicholas M.** Stratigraphy and deformational history of rocks of the Taconic Range near Great Barrington, Massachusetts, Trip 2 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 2-1 — 2-23, illus., 1969.

A road log for a field trip of 25 miles is included; it begins in the Berkshire spur in Massachusetts and ends in Stockbridge, with nine stops described. The trip deals specifically with the stratigraphy of the rocks of the Chatham and Everett slices of the Taconic allochthon and their relation to the underlying autochthonous rocks. The autochton includes the Dalton Formation, late Precambrian or Cambrian; and the Cheshire Quartzite, and Stockbridge and Walloomsac Formations, Cambrian to Middle Ordovician; and the allochthon includes the Nassau and Everett Formations, late Precambrian or Early Cambrian. The two major overlapping thrust slices are described; Taconic folding is also evident. Low grade metamorphism accompanied some of the late tectonic events. — HRC

Rau, Weldon W. *See* Snavely, Parke D., Jr. 07892

08065 **Raup, David M.** Computer as a research tool in paleontology, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 189-203, illus., 1969.

A variety of applications are emerging wherein computers are used as research tools in paleontology. Modeling and simulation techniques have been applied to making of graphical constructions of morphology; of particular interest is the capability of producing a spectrum of theoretically possible morphologies for a given group of organisms, making it possible to see occurring forms in better perspective and opening the way for use of optimization techniques in testing of paradigms. To date most morphologic models have been deterministic, but one involving behavior of burrowing organisms is partially stochastic. Further development of stochastic models may be expected where such models are plausible biologically, i.e., morphology of colonial corals. Coordinate transformation techniques could revolutionize the study of morphology; optical scanning and image recognition techniques may become valuable in morphologic description. — *from* Author's abstract

00340 **Raymond, Loren A.** Del Puerto keratophyres and Lotta Creek tuffs — Great Valley not Franciscan rocks [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 133, 1970.

00341 **Raymond, Loren A.** Relationships between blueschist facies metamorphism, folding, and faulting in Franciscan rocks, Seegers Ranch area, northeastern Diablo Range, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 133-134, 1970.

00459 **Rea, David K.** Changes in structure and trend of fracture zones north of the Hawaiian ridge and relation to sea-floor spreading: Jour. Geophys. Research, v. 75, no. 8, p. 1421-1430, illus., 1970.

The major east-west fracture zones north of the Hawaiian Ridge all undergo marked changes in topography, magnetic characteristics, and trend as they cross a narrow strip extending northwest from 156° W, 21° N to 174° W, 43.5° N. This strip, termed the bending line, marks the location of a major change in the direction of sea-floor spreading in the north Pacific Ocean. Extrapolation of present spreading rates indicates an early Cretaceous age for the bending line. Minor structural features including shear zones and a small fracture zone found in the well-mapped area east of the bending line between the Murray and Pioneer fracture zones may have resulted from the reorientation of spreading centers. Later formation of the Musicians seamounts may have been controlled by a zone of weakness along the bending line. — Author's abstract

Reasenberg, Paul. *See* Aki, Keiiti. 00219

08075 **Reed, G. W.; Jovanovic, S.** ^{196}Hg and ^{202}Hg isotopic ratios in chondrites: Jour. Inorganic and Nuclear Chemistry, v. 31, no. 12, p. 3783-3788, tables, 1969.

An apparent discrepancy has been observed in the isotopic composition of Hg-196 and Hg-202 in a few of the fractions collected during the volatilization of Hg from chondritic meteorites. So far, a generally acceptable radiochemical explanation of these occurrences has not been found but this search should be further exhausted before these results are accepted as anomalies. — Authors' abstract

07779 **Reed, John C.** The story of the Naval Arctic Research Laboratory, *in* U. S. Naval Arctic Research Lab. Dedication Symposium, Fairbanks, Alaska, 1969, Proc.: Arctic, v. 22, no. 3, p. 177-183, 1969.

The Laboratory, established by the U. S. Navy in August, 1947, with very little fanfare, is now the only U. S. laboratory devoted to full time basic research in the arctic; from it has come a steady flow of arctic environmental knowledge. In the United States, interest in ice islands began in 1952 with the discovery and occupation of T-3, and later of ARLIS II. About 1500 persons have played a significant role as individual researchers or as members of research teams up through 1966, and 74 American and numerous foreign universities have been involved. The various aspects of arctic research carried out have included geological and geophysical studies. — HRC

Reeves, C. C., Jr. *See* Bates, T. R. 00429

00342 **Reimnitz, Erk.** Surf-beat and related strong, pulsating bottom currents in the Rio Balsas submarine canyon, Mexico [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 134, 1970.

07967 **Reitan, P. H.** Temperatures with depth resulting from frictionally generated heat during metamorphism, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 495-512, illus., table, 1969.

The computations presented here of temperature increases at eight depths for each of 40 models show that frictional heat may result in significant local elevation of temperature. Variables used in computations are: time and rate of heat generation, and depths of boundaries within which heat is generated. Average energy per gram converted to heat and strain rate within the deforming part of the crust are computed for each model. Frictional heat due to deformation is not solely responsible for temperatures of regional metamorphism, but may, when deformation is concentrated in space and time, account for local steepening of the temperature gradient, and locally

for a mineral assemblage of higher metamorphic grade than would otherwise have been present. — *from* Author's abstract

07910 **Renaud, A.** (and others). Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959 [with English and German abs.] — Exped. Glacial. Internat. Groenland, V. 5, No. 3: Medd. Grönland, v. 177, no. 2, 123 p., illus., tables, 1969.

This report of the International Glaciological Expedition to Greenland in the summer of 1959 contains 11 papers and a summary paper, covering the work of the expedition on isotope analysis and gas composition of ice samples from 6 stations on the icecap between long 32-48° W. and lat 69-72° N. Deuterium and tritium contents were determined. The presence of lead-210 was discovered in the ice for the first time. The 11 papers are cited separately. — EH

Renaud, A. *See* Aegerter, S. 07915

07917 **Renaud, A.** Observations sur la glace bordière, *in* Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, p. 107-110, illus., 1969.

Ice samples from several sites in the western part of the Greenland Icecap were analyzed for air, deuterium and tritium contents, and pressure, and density. Results were inconclusive, partially due to contamination of samples taken from shallow depths. The author recommends taking future samples from greater depths and during the winter. — EH

08069 **Renaud, A.** Observations sur la glace surimposée, *in* Études physiques et chimiques sur la glace de l'Indlandsis du Groenland 1959: Medd. Grönland, v. 177, no. 2, p. 93-100, illus., tables, 1969.

Samples of superimposed ice from two locations near the western edge of the Greenland Icecap were analyzed. The samples had correspondingly high tritium content and substantially the same deuterium and O-18 content as the local precipitation. Analysis of samples at one site proved continued accumulation of superimposed ice between 1950 and 1959. At the other site the formation of superimposed ice during the same period was found to be a seasonal phenomenon, taking place at the beginning of spring. — EH

00343 **Reynolds, Mitchell W.** Low-angle faults of lag and gravity origin, northeastern Death Valley, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 134-135, 1970.

07764 **Rib, Harold T.; Miles, Robert D.** Automatic interpretation of terrain features: Photogramm. Eng., v. 35, no. 2, p. 153-164, illus., 1969.

Identification of terrain features is based on interpretation of elements of form, and of tone and texture. Measurements of the latter were performed with a densitometer adapted to obtain continuous scans. Measurements were also performed on multichannel imagery (ultraviolet through far infrared) and spectral response signatures were developed for various target materials. Analysis of spectral response curves developed from this imagery indicated that this approach offered the greatest potential for delineating features. A technique was developed for preparation of isochromal maps (showing uniform color zones) from densitometric scans, automatically mapping tonal patterns present on color photos; this has application for identification of those terrain features directly related to color tonal patterns. Efforts to develop diagnostic patterns for various terrain features from measurements on a single film type were not successful. — ESL

00344 **Rich, Ernest I.** Structural interpretation of late Mesozoic rocks in the Pope-Chiles Valley area, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 135, 1970.

00345 **Richter, C. F.** Seismicity of the Inglewood fault and adjacent areas [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 136, 1970.

08038 **Ridler, Roland Hartley.** The relationship of mineralization to volcanic stratigraphy, in the Kirkland Lake area, Ontario [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2763B-2764B, 1969.

00346 **Ridley, Albert P.** Paleozoic submarine rockslide deposits, Inyo Mountains, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 136, 1970.

08098 **Riedel, D. W.** Geology of the Tepee Trail Formation, Badwater area, Fremont and Natrona Counties, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 39-41, 1969.

Details of the Tepee Trail Formation are given. The lowermost Green and Brown Member has several facies within it. A coarse-grained facies, near the depositional edge, as a result of nearby uplift and volcanism, masks the otherwise coarse-grained volcanic unit previously recognized. These lie unconformably over the Wind River Formation. The Hendry Ranch Member overlies and interfingers with the Green and Brown Member and is lacustrine in origin. It is here restricted to the gray and buff tuffaceous mudstones and interfingering limestones, excluding unconformably overlying siltstones and sandstones. Age dating of some shows the Hendry Ranch as here defined to be Eocene in age. Some detailed measured sections are included. — HRC

Riley, R. A. *See* Ayres, L. D. 07920

00347 **Rinehart, John S.** Relationships between earth strain and geothermal activity [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 136-137, 1970.

Rinehart, W. A. *See* Algermissen, S. T. 00221

08082 **Ritchie, Jerry C.; Plummer, Gayther L.** Natural gamma radiation in northeast and east-central Georgia: Georgia Acad. Sci. Bull., v. 27, no. 4, p. 173-194, illus., tables, 1969.

Natural thorium, uranium and potassium, and various fallout nuclides were found in soils of the Piedmont, Sand Hills, and Coastal Plain. Concentrations in granitic outcrops compared with nonoutcrop soils were the same for thorium and uranium, three times greater for potassium, and ten times for cesium-137. Average Th and U concentrations were higher in the study area than those reported worldwide, probably due to monozite in the Georgia Piedmont; commercial uranium ores are usually 100 times more concentrated. Neither uranium nor the less mobile thorium was highly concentrated in plant or animal tissues, whereas potassium is an active metabolite. Total gamma radioactivity had a 16-fold range; calculated dose rates averaged 10.65 μR/hr for the 132 soils. Distributed in broad geologic patterns, concentrations were lowest in sandy Coastal Plain, and highest in basic igneous metamorphic Piedmont materials. — GDC

Ritter, John R. *See* Helley, Edward J. 00282

07848 **Riva, John.** (leader). Utica and Canajoharie Shales in the Mohawk Valley, Trip 13 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 13-1 — 13-7, illus., 1969.

Six stops on a field trip from Albany to Frenchville, New York, are described in detail, with emphasis upon the stratigraphic relations. Some of the typical outcrops are visited and the typical faunas of the lower and upper Mohawk Valley are seen. The contact with the underlying and interdigitating Trenton limestone is studied at the most classical localities. A chart showing the ranges of the characteristic graptolites in the rocks is included. — HRC

00348 **Robinson, Paul T.** Petrology of the Silver Peak volcanic center, western Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 137, 1970.

Rodda, P. U. *See* Murphy, M. A. 08072

07812 **Rodgers, John; Fisher, Donald W.** Paleozoic rocks in Washington County, N. Y., west of the Taconic klippe, Trip 6 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 6-1 — 6-12, illus., 1969.

The detailed stratigraphic subdivision of the western carbonate shelf section is based mainly on the relatively subtle differences in the carbonate rocks and their content of quartz sand and silt and on the rather sparse fossils. A simplified section is: (Cambrian) Potsdam Sandstone, Ticonderoga Formation; (Cambrian and Ordovician) Whitehall Formation; (Ordovician) Cutting, Bascom, Providence Island Formations, and Orwell and Glens Falls Limestones, and Canajoharie Shale. Four field trip stops but no road log are included; each stop is described in detail. — HRC

07988 **Roehler, Henry W.** Stratigraphy of oil-shale deposits of Eocene rocks in the Washakie Basin, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 197-206, illus., 1969.

Washakie Basin is structural and topographic, and is bounded on the east by the Sierra Madre Mountains, on the north by the Wamsutter arch, on the west by the Rock Springs Uplift, and on the south by the Cherokee Ridge. About 80 percent of the rocks in the basin are Eocene and are the Wasatch and Green River Formations. Various tongues and members of each are described, and their interrelations are discussed. The Laney Shale Member of the Green River Formation contains the oil shale in the greatest quantity, but other members also contain oil shale. The distribution and stratigraphic position of the oil shales are described. — HRC

Rogers, J. R., Allen, B. L. *See* Stahnke, C. R. 08061

Rogers, Mark. *See* Estavillo, William. 00262

07972 **Rohrer, W. L.; Smith, John Ward.** Tatman Formation, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 49-54, illus., tables, 1969.

Two detailed measured sections of the Tatman Formation from Big Horn and Park Counties, Wyoming, are presented, along with some other information from other sections measured throughout the Big Horn basin. In addition, analyses of kerogenic shales from the Tatman are included. The formation is shown to be a basinward facies of the Willwood Formation of Eocene age, and is overlain conformably by the Pitchfork and Tepee Trail Formations. Further, it is shown that the base of the Tatman Formation may be different ages at different places and the formation is presumed to span the early-middle Eocene time boundary. Differences in facies of the Tatman can be shown to be a product of different sedimentary environments as well as provenance. — HRC

Roller, J. C. *See* Lee, W. H. K. 00304

00349 **Romig, P. R.; VanWormer, J. D.; Tocher, Don; Wideman, C. J.** Residual strains associated with Jorum [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 137, 1970.

Romney, Carl F. *See* Engdahl, Eric R. 00260

08070 **Rose, Robert L.** Geology of parts of the Wadsworth and Churchill Butte quadrangles, Nevada: Nevada Bur. Mines Bull. 71, 27 p., illus., geol. map, 1969.

A Mesozoic sequence of rocks, consisting of Jurassic metasediments and metavolcanics, possible Jurassic dioritic rocks, and Cretaceous granitic rocks, covers less than ten percent of the area. The Tertiary succession includes a thick, complex, and extensive series of volcanic rocks and associated sediments that have been folded, faulted and more or less hydrothermally altered and mineralized. The Pleistocene rocks are relatively undisturbed and unaltered lacustrine and fluvial sediments and

volcanic rocks. The stratigraphy is summarized in a table. In the Tertiary rocks gentle folds generally trend approximately east-west and are cut by high-angle, normal, reverse and oblique slip-faults. Tectonic activity was probably contemporaneous with Cenozoic volcanism. The area has been extensively prospected for gold, silver, uranium, iron and diatomite, the latter currently mined near Clark. — EH

07907 **Rosenfeld, Melvin A.; Bowin, Carl O.** Computers in oceanography, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 205-222, illus., 1969.

Unique aspects of computers in oceanography are probably those based on tactics rather than on science — using computers and plotters on ships to aid in data acquisition problems, making computations to verify working status of instruments and make decisions for future actions, and controlling dynamic positioning of ships while drilling. Unattended data acquisition systems collect data on special digital magnetic tapes; other devices on board ship and on land acquire data on analog tapes which must be translated to computer compatible tape for analysis. The vast amount of data acquired creates a data-management problem; one federal facility (Fleet Numerical Weather) is an example of real-time distributor of certain oceanographic measurements and another (National Oceanographic Data Center) serves as an archive from which a wide variety of data can be obtained but not in real time. — *from* Authors' abstract

00350 **Ross, Charles A.** Late Paleozoic carbonate shelf ecology [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 138, 1970.

00351 **Ross, Donald C.** Plutonic rocks of the California Coast Ranges [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 138, 1970.

08019 **Ross, G. J.** Acid dissolution of chlorites — Release of magnesium, iron and aluminum and mode of acid attack [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 17, no. 6, p. 347-354, illus., tables, 1969.

Dissolution of 8 chlorites in 2N Si-saturated HCl showed no preferential dissolution of Al in octahedral positions and that octahedral and tetrahedral sheets were equally attached. Analysis of chemical data suggested a simple two-dimensional diffusion model in which acid attack on chlorite particles proceeded from edges inward leaving a reacted layer which formed a diffusion barrier. Microscopic examination showed that acid attack was not simply on edges but started at any point of defect or weakness. The residue was an opaline amorphous hydrated silica. Arrangement of etch figures on flakes of some chlorites reflected certain crystal symmetry elements. Results indicate that the acid dissolution technique to determine the ratio of Al in octahedral and tetrahedral positions can not be used as an aid in calculation of structural formulae for chlorites. — *from* Author's abstract

Roth, E. *See* Dansgaard, W. 07914

Roth, E. *See* Oeschger, H. 07918

00444 **Rowe, M. W.** ^{81}Kr radiation ages of stone meteorites: Nature, v. 225, no. 5230, p. 368, 1970.

The radiation ages as estimated by Kr-81/Kr-78 by Marti (1967) and by Eugster and others (1967) seem systematically higher than the published He-3 radiation ages. This may be due to the fact that they overestimated the relative production rate, P(Kr-81)/P(Kr-78). If the ages are recalculated on the assumption that the production rate of Kr-81 is the same as that of Kr-80, the Kr-81/Kr-79 ages of all but one of the meteorites (Macibini) are brought into excellent agreement with the He-3 ages. — DBV

07803 **Ruitenberg, A. A.** Mineral deposits in granitic intrusions and related metamorphic aureoles in parts of Welsford, Loch Alva, Musquash, and Pennfield areas: New Brunswick Dept. Nat. Resources Mineral Resources Br. Rept. Inv. 9, 24 p., illus., tables, geol, maps [1969].

Several mineral belts, characterized by one or more types of deposits have been delineated in southern New Brunswick. This preliminary report considers a few typical examples in granitic rocks and related metamorphic aureoles, indicated on sketch maps of six prospects. Major deposits distinguished are: lead-zinc-copper, tungsten-tin-molybdenum, copper-silver-molybdenum, and lead-zinc-silver. Briefly described are the Nerepis synform, Jake Lee Brook area in Lennfield, and Square Lake area near Welsford, all the Mascarene-Nerepis belt; the Eagle Lake stock area in the Loch Alva-Kingston belt; and an antiform in the Frenchman's Creek area, and similar area at Scott Falls on the Musquash River, in the Caledonia belt. Major structures are cut by fracture zones and block faults in which the metals are localized. The stratigraphy and most important features of the deposits are summarized in tables. — GDC

Ruitenberg, A. A. *See* Potter, R. R. 07921

Rush, Clayton. *See* Sanford, Allan. 00354

07832 **Rust, James E.** Spectra analysis of the Gulf of California earthquake swarm of March 1969 [abs.]: Earthquake Notes, v. 40, no. 4, p. 13, 1969.

07765 **Rutland, R. W. R.** Graphic determination of slope and of dip and strike: Photogramm. Eng., v. 35, no. 2, p. 178-184, illus., 1969.

This stereographic method for determining strike and dip requires only that two geologic outcrop lines of the bedding be observed. They need not be the same level nor from the same bedding plane. The method can also be applied to the determination of slope. The attitude of only one line is required and considerably less work is involved than for the strike and dip problem. No corrections for relief displacement or vertical exaggeration are required. The method can also be applied to oblique photographs. — Author's abstract

08109 **Rutter, Nathaniel W.** A Late-Pleistocene glacial advance, Bow River valley, Alberta, Canada [with French abs.], *in* Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, p. 104-109, illus., 1969.

In the Bow River valley, Banff National Park, Alberta, a relatively recent glacial advance took place. The glacier, originating at the head of the valley, flowed as far as Eisenhower Junction, approximately 40 miles, receiving ice from tributary valleys along its way. Evidence for the advance is based on geomorphic criteria and related glacial deposits, such as relatively fresh lateral moraines and cirques, and breaks in slope from glacial scouring and side-glacial stream action. The extent of the advance was determined by an end moraine, consisting of ice-contact outwash, by the relative development of the post-glacial Bow River and flood plain plus alluvial fans from tributary creeks, and by distribution of cirques and glacial troughs. Its minimum age, from charcoal samples, is 9,330±170 yr ago. Evidence is also present for a minor readvance. — *from* Author's abstract

Ryall, Alan. *See* Hofmann, R. B. 00286

00352 **Ryan, Barry D.** Rubidium strontium geochronology of the Hellroaring Creek stock, southeast British Columbia [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 139, 1970.

07864 **Saad, Afif Hani.** Paleomagnetism of Franciscan ultramafic rocks from Red Mountain, California: Jour. Geophys. Research, v. 74, no. 27, p. 6567-6578, illus., tables, 1969.

Results from the study of the magnetism in serpentinized ultramafic rocks of the Red Mountain intrusion southeast of San Francisco, Calif., suggest that these rocks possess a chemical remanent magnetization acquired during serpentinization. A study of the stable directions of magnetization indicates that the Red Mountain ultramafic body was emplaced and serpentinized prior to the folding of the Franciscan Formation. Methods of verification of the results are discussed. Paleomagnetic pole positions calculated from the mean directions suggest that the magnetic pole rapidly

migrated southward into the Atlantic Ocean during the late Mesozoic, possibly more than once. — GV

Sadowski, Bernard S. *See* Brotherton, Miner K. 07783

07924 **Salamis, C.; Gaucher, E.** A geophysical copper discovery in Louvicourt township, *in* Guidelines to prospecting — A symposium: Canadian Mining Jour., v. 90, no. 4, p. 110-113, illus., 1969.

The first drill hole sited to explore the center of an electromagnetic anomaly on the Neganta-Nemrod-Timrod property, cut a 120-ft section containing more than six percent copper. Further drilling has indicated about 500,000 tons of three percent copper to a depth of 500 feet. The paper deals with the exploration history of the property, the geologic setting, exploration approaches leading to the discovery, and a discussion of test geophysical techniques performed over the deposit (including two horizontal loop E.M. systems, induced polarization, magnetic, and gravity surveys). In addition the subsurface electrical properties as determined by a depth sounding resistivity survey, and drill hole detection log are reviewed in the light of the surface results. Significant results of the I.P. survey are discussed. — ESL

Samuelson, Alan C. *See* Voight, Barry. 07777

00353 **Sandberg, Charles A.; Poole, Forrest G.** Conodont biostratigraphy and age of West Range Limestone and Pilot Shale at Bactrian Mountain, Pahranagat Range, Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 139, 1970.

07820 **Sanders, John E.** Bedding thrusts and other structural features in cross section through "Little Mountains" along Catskill Creek, (Austin Glen and Leeds Gorge), west of Catskill, New York, Trip 19 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 19-1 — 19-38, illus., table, 1969.

The rocks from the Austin Glen Member of the Normanskill Formation to the Onondaga Formation are described in detail, and various structures are examined. Bedding thrusts and other types of deformation are present, and an Appalachian-orogeny-age deformation is supported rather than an Acadian, currently in vogue. There is an older, noncalcareous, graded graywacke-siltstone complex of Middle Ordovician age whose chief fossils are graptolites, and a younger, Silurian-Devonian succession, including many kinds of carbonate rocks and siltstones, containing abundant brachiopods. — HRC

00354 **Sanford, Allan; Rush, Clayton; Alptekin, Omer.** Study of a seismically active segment of the Rio Grande rift zone [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 139-140, 1970.

Santos, G. G. *See* Wainerdi, R. E. 07993

00355 **Saragoni, Rudolfo; Hart, Gary C.** Nonstationary frequency content of earthquake bedrock motions [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 140, 1970.

00356 **Sargent, K. A.; Houser, F. N.** The Shingle Pass Tuff of central Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 140-141, 1970.

00357 **Sass, J. H.** Heat flow in relation to the major structures of central California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 141, 1970.

Sater, J. E. *See* Monson, A. P. B. 07778

08053 **Savage, C. N.** Distribution and economic potential of Idaho carbonate rocks: Idaho Bur. Mines and Geology Bull. 23, 93 p. illus., 1969.

The report reviews occurrences of carbonate rocks with comments on economic, geographic, qualitative and quantitative aspects. Analyses of samples and data from published sources are included in an appendix. The largest reserves occur in south, south-central and southeastern marine Paleozoic and Mesozoic strata. Northwest and west-central Permian and Triassic marine limestones are also plentiful and reasonably widespread. Locally they are contaminated with materials of volcanic origin. The 'Orofino Series' of carbonate rocks of Precambrian age are reasonably widespread. Cambrian limestones and dolomite occur near Pend Oreille Lake. Travertine and algal limestone deposits are associated with several warm and hot springs in southern Idaho. Other lime occurrences in Precambrian or Tertiary rocks are widely scattered, but most are too low in lime content to be of value. — *from* Author's abstract

Savage, J. C. *See* Neave, K. G. 00458

00358 **Savage, James C.** Migration of seismic activity along the west coast of North America [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 141, 1970.

07789 **Scarbrough, W. Leon; Joiner, Thomas J.; Warman, James C.** Electrical resistivity survey in the Piedmont area, Alabama: Alabama Geol. Survey Circ. 57, 20 p., illus., 1969.

In the Piedmont, developing adequate water supplies for municipal, industrial, and agricultural needs is very difficult and involves extensive test drilling. Ground-water movement is controlled by topography, rock type, fracture and joint systems, recharge and discharge, and thickness of the mantle over bedrock. Approximately 12 sq mi in the Heflin area and 2 sq mi about 10 miles southeast of Heflin were included in this study. Electrical resistivity investigations were made, assuming that weathered or solutionally enlarged water-bearing openings along fractures in the bedrock would be more conductive than solid unaltered bedrock and would be indicated as conductive anomalies. A semi-empirical method using the bedrock surface as a datum plane has been successful in other areas of Alabama, but had not been used in the Piedmont area. — *from* Authors' abstract

08043 **Schabilion, Jeffry Tod.** A study of the anatomy and taxonomy of the genus *Sphenophyllum* [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2831B, 1969.

07880 **Schafer, C. T.** Distribution of sediments on the tops of Mid-Atlantic Ridge mountains: Maritime Sediments, v. 5, no. 2, p. 51-55, illus., table, 1969.

On a recent cruise of the Canadian S. S. HUDSON over the Mid-Atlantic Ridge, near 45°, a camera was attached to the deep-sea drill. Rock cores collected on 9 mountains along the crest are chiefly coralline limestone and basalt. Bottom photos suggest primarily one, or a combination of seven possible substrates for the mountain tops: pebbles (mostly basic igneous) and boulders, with isolated growths of living coral; dense growths of coral associated with pebbles or minor amounts of calcareous ooze; areas with no coral, but bottom-current concentrated pebbles mixed with ooze; pebbles and skeletal coral debris deposited over coralline limestone, where absence of ooze may be due to winnowing action of strong bottom currents despite a water depth of 1682 m; ooze with pebbles and coral fragments (over 166 cm thick) where currents are slower, overlying coralline limestone or massive vesicular basalt. — GDC

Scheidegger, A. E. *See* Liao, K. H. 07947

Scheidegger, Adrian E. *See* Pulpan, Hans. 07775

00494 **Schirner, Silas W.** Study of student outcomes in earth science classes [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 375-376, 1970.

07794 **Schlocker, Julius.** The geology of the San Francisco Bay area and its significance in land use planning *in* Urban environmental geology in the San Francisco Bay region (E. A. Danehy and R. C. Harding, editors): Sacramento, Calif., Assoc. Eng. Geologists, p. 7-24, illus., tables, 1969; originally published 1968.

Rocks of Jurassic to Recent age are present, and each type and its engineering properties are described. Included are granitic rocks, the Jurassic Franciscan Formation, the Great Valley sequence, ultramafic rocks, sedimentary and volcanic rocks of Tertiary age, sediments of late Pliocene to Holocene age, and sediments of San Francisco Bay. Included also are brief descriptions of the economic values of the various materials. Landslides and earthquakes in the Bay region are well known and active studies are continually progressing. Certainly any long-range planning would need to take into account these two especially obvious hazards. — HRC

08166 **Schmoker, James William.** Interpretation of aeromagnetic, magnetic, and gravity data from the San Francisco Mountains vicinity, southwestern Utah [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2764B-2765B, 1969.

00359 **Scholl, David W.; Marlow, Michael S.; Creager, Joe S.; Holmes, Mark L.; Wolf, Stephen C.; Cooper, Alan K.** A search for the seaward extension of the Kaltag fault beneath the Bering Sea [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 141-142, 1970.

Schumacher, E. *See* Hughes, B. 07913

Schumacher, E. *See* Aegerter, S. 07915

Schumann, T. G. *See* Powell, A. W. 07989

08180 **Schumm, S. A.** Geomorphic implications of climatic changes, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 525-534, illus., 1969.

Geomorphic evidence of a climate change is evidence only of a change in the hydrologic variables of runoff and sediment yield, so that the relations of climatic, phytological and hydrologic variables must be considered before the influence of climate alone on the landscape can be evaluated. Sediment movement lends itself well to such study, and the discussion given here of the influences upon sediment movement includes several sediment-yield curves for different temperatures. Changes in the channel system can also be studied as there is a relation between the channel length per area and the number of channels per area as a function of the amount of runoff. Equations are developed to show the relation of discharge to width, depth, meander wavelength, and gradient. Such relations are important inasmuch as man as well as climate can change sediment movement and thus river characteristics. — HRC

07801 **Schwalb, Howard R.** Deep (Cambro-Ordovician) exploration in western Kentucky, *in* Kentucky Oil and Gas Assoc., 32d Ann. Mtg., 1968, Proc. Tech. Sess.: Kentucky Geol. Survey Spec. Pub. 17, p. 16-19, illus., 1969.

Only 16 tests have been drilled into the Knox section in western Kentucky, including the Jackson Purchase region. Although no commercial oil production has been obtained below the Middle Ordovician Plattin Limestone, encouraging factors for potentially commercial accumulations are evident: a thick carbonate and sandstone section with demonstrated zones of porosity, generally moderate drilling depths, and numerous opportunities for pinchouts and other stratigraphic traps especially in association with a series of unconformities. A regional cross section through western Kentucky and stratigraphic sequences of Lower Paleozoic rocks in the Jackson Purchase region and in eastern Missouri are given. — *from* Author's abstract

08143 **Schwarz, E. J.** A discussion of thermal and alternating field demagnetization methods in the estimation of paleomagnetic field intensities: Jour. Geomagnetism and Geoelectricity, v. 21, no. 3, p. 669-677, illus., 1969.

A brief discussion is given of the thermal and alternating field demagnetization methods in estimating paleomagnetic field intensities. It appears that reliable paleomagnetic intensity estimates may be obtained by alternating field demagnetization if (1) the results can be successfully extrapolated towards the highest microcoercivities of the NRM and of the TRM, and (2) the saturation magnetization has not changed appreciably after heating the sample to the Curie temperature and subsequent cooling. This would imply that the application of the "complete alternating field method" is not necessarily less laborious than that of the thermal method for which thermomagnetic analyses probably are not essential. — Author's abstract

08055 **Schweger, Charles Earl.** Pollen analysis of Iola Bog and paleoecology of the Two Creeks Forest bed, Wisconsin: Ecology, v. 50, no. 5, p. 859-868, illus., 1969.

Pollen analysis of two exposures of the Two Creek Forest bed, in Outagamie and Brown Counties, were completed, and a simple flora dominated by boreal wetland pioneers *Picea* and *Larix* along with Cyperaceae is revealed. High amounts of nonboreal pollen, lack of stumps, roots, and logs, and field relations indicate the Two Creeks was an open boreal woodland. The bog near Iola, Waupaca County, provided a late-glacial pollen record outside the region of the Valders advance; this was divided into nine zones, correlating with known glacial and climatic fluctuations, and with other work in central Wisconsin. A basal *Picea*-Cyperaceae assemblage is replaced by a species-rich, mesic vegatation representing the Two Creeks interval. A drying trend is correlated with the Valders advance; zones above this, record the postglacial *Pinus* invasion and the Hypsithermal. — *from* Author's abstract

Scott, Martha R. *See* Scott, Robert B. 07865

07865 **Scott, Robert B.; Bachinski, Sharon W.; Nesbitt, Robert W.; Scott, Martha R.** Structural states of alkali feldspars in ignimbrite cooling units [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 202, 1969.

08076 **Sebert, L. M.** Topographic maps of glaciated areas — A cartographer's reply to W. E. S. Henoch [1969]: Canadian Cartographer, v. 6, no. 2, p. 129-131, 1969.

The author states that some of the glacial features which Henoch [ibid., p. 118-129] suggested should be included on national and provincial topographic maps are already being depicted on medium and large-scale map series. Other suggested ice features should be incorporated on special glacier maps instead of on the general-purpose topographic maps. Sebert cites the difficulty in obtaining late-summer aerial photography of glaciers for cartographic purposes, due to arctic solar and climatic conditions. He questions the portrayal of changeable features such as crevasses and surface drainage on glaciers. — EH

07828 **Seeber, Leonardo; Barazangi, Muawia; Nowroozi, Ali A.** Seismicity and tectonics of northern California using high resolution techniques [abs.]: Earthquake Notes, v. 40, no. 4, p. 9-10, 1969.

Seed, H. Bolton. *See* Kovacs, W. D. 00298

08010 **Seidl, V.; Knop, Osvald; Falk, Michael.** Infrared studies of water in crystalline hydrates — Gypsum, $CaSO_4 2H_2O$: Canadian Jour. Chemistry, v. 47, no. 8, p. 1361-1368, illus., tables, 1969.

Infrared spectra of partially deuterated hydrates yield the fundamental frequencies of isotopically dilute H_2O, D_2O, and HDO molecules. Isotopic dilution eliminates vibrational coupling and allows determination of total number of crystallographically distinct water molecules in the crystal. It also yields the number of distinct symmetric and asymmetric water molecules. Results for gypsum show that all water molecules are equivalent and are asymmetric, in agreement with crystallographic results. Extent of asymmetry is measured by the difference between the two OH stretching frequencies of HDO molecules. This corresponds to an estimated difference of 0.02 A in the O. . . O distances of the two hydrogen bonds. Spectra of partially deuterated gypsum show that spectral features previously explained by two sets of distinct water molecules or by proton tunnelling, are due to vibrational coupling. — *from* Authors' abstract

Sendlein, Lyle V. A. *See* Tri-State Geological Field Conference. 08112

08113 **Sendlein, Lyle V. A.** Geology and geohydrology of the upper Skunk River, Iowa, *in* The many faces of geology — Tri-State [Geol.] Field Conf., 33d, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, p. 12-27, illus., 1969.

This discussion is condensed from a report by Sendlein and Dougal (1968) presented to the U. S. Corps of Engineers as part of a study of the proposed Ames Reservoir. It includes the surficial and bedrock geology, geohydrology, and a geophysical (electrical, seismic) study of the area. Objectives of the study were to locate a buried bedrock valley segment of the Skunk River, which bypasses the proposed dam site, and to estimate the amount of seepage through this segment under conservation and flood-pool conditions of the proposed reservoir. A small fault was found along the east valley wall, cutting across the left abutment of the dam. — *from* Author's abstract

Seyfert, Carl K. *See* Leveson, David J. 07964

08044 **Shaffer, Bernard Leroy.** Palynology of the Michigan "Red Beds" [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2831B, 1969.

Shahbazi, M. *See* Mobasheri, F. 08090

08007 **Sharma, Ghanshyam.** Paragenetic evolution in Peejay Field, British Columbia, Canada: Mineralium Deposita, v. 4, no. 4, p. 346-354, illus., 1969.

Triassic sediments from the Halfway Formation are described with special reference to mineral alterations during diagenesis. Deposited along an irregular coastline during middle Triassic transgression, the vertical succession is complex and considerably altered; major lithologic concerns are silty sandstones, dolarenite, dololutite, sporadic coquinoids, and shell debris largely pelecypods, diagenetic-altered to dolomite. Evaporites were introduced through solution and precipitation or by replacement. In certain sandstone units, intense corrosion to complete replacement of clastic quartz as well as matrix by dolomite is observed. Introduction or removal of minerals during diagenesis may result from physico-chemical changes in equilibrium between sediments and the interstitial fluid caused by burial. Hence, study of diagenetic minerals and paragenesis may be important to interpret depositional environment and postdepositional history. — *from* Author's abstract

Sharp, Robert V. *See* Duffield, Wendell A. 00257

Shaughnessy, Jack. *See* Martin, W. B. 07982

00482 **Shaw, Denis M.** Trace element fractionation during anatexis: Geochim. et Cosmochim. Acta, v. 34, no. 2, p. 237-243, illus., 1970.

The theoretical basis of trace-element fractionation presented in a paper by P. W. Gast (1968) can be developed in a more flexible algebraic form, which is here described and illustrated. — Author's abstract

00360 **Sheehan, Peter M.** Development of Silurian marine communities in the Great Basin [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 143, 1970.

Sheridan, Michael F. *See* Ragan, Donal H. 00339

08005 **Shlien, Seymour; Toksöz, M. Nafi.** Statistical study of earthquake occurrences [abs.]: Earthquake Notes, v. 40, no. 4, p. 18, 1969.

00402 **Shrock, Robert R.** Walter Lucius Whitehead (1891-1969): Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 363-364, portrait, 1970.

08006 **Shurbet, D. H.** Development of the Gulf Coast Geosyncline: Texas Jour. Sci., v. 20, no. 3, p. 243-247, illus., 1969.

Gravity data alone can be interpreted to indicate that the Gulf Coast Geosyncline developed over either oceanic or continental crust. Magnetic measurements, made on land, are used to strengthen the conclusion that the geosyncline developed over oceanic crust. This interpretation is in agreement with the observation that high-frequency S phases from Central American earthquakes recorded at Lubbock, Texas, indicate that the upper mantle beneath part of the continental shelf and the Gulf Coastal Plain is more like the upper mantle beneath the ocean crust than like that beneath continental crust. — Author's abstract

Sibley, Gretchen. *See* Macdonald, J. R. 08157

00361 **Silberling, N. J.** Thrust faulting of the Havallah sequence in the Sonoma Range, north-central Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 143-144, 1970.

Silberling, N. J. *See* Wallace, R. E. 08154

Silberling, N. J. *See* Wallace, R. E. 08155

Silberman, Miles L. *See* McKee, Edwin H. 00314

08056 **Simmonds, P. G.; Gauman, A. J.; Bollin, E. M.; Gelpi, E.; Oró, J.** The unextractable organic fraction of the Pueblito de Allende meteorite — Evidence for its indigenous nature: Natl. Acad. Sci. Proc., v. 64, no. 3, p. 1027-1034, illus., table, 1969.

The new chondrite, which fell Feb. 8, 1969 in Mexico, contains 0.1-0.5 ppm of solvent-extractable carbon, mostly due to terrestrial contamination. Total carbon content is 0.23 to 0.35 percent, so the ratio of presumed indigenous insoluble carbon to contaminated carbon is 2300:1. Contaminants were extracted and the sample was subjected to pyrolysis-gas chromatography- mass spectrometry to investigate the nature of remaining carbon. Pyrolysis products, about 20 ppm, consisted chiefly of aromatic and substituted aromatic hydrocarbons. Results, confirmed by oxidative thermal analysis, showed that the bulk of carbon present was a macromolecular structure and not graphite, suggesting that an insoluble nongraphitic condensed aromatic polymer is indigenous to the meteorite. Origin and precise chemical structure of this material have not been determined, but it bears a superficial resemblance to coal-like structures. — *from* Authors' abstract

00362 **Simonds, George.** Public policy requirements to minimize earthquake risk in Hayward, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 144, 1970.

Simoneit, Bernd R. *See* Burlingame, A. L. 07994

07975 **Single, E. L.** Pavillion Field, Fremont County, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 101-103, illus., 1969.

The field is located on a local structural closure developed on a southeast plunging regional anticline, an extension of, or *en echelon* to, the Maverick Springs-Little Dome surface anticlinal trends. The gas reservoirs are lenticular sandstones of Fort Union and Wind River Formations. The variable deposition of the sands makes correlation between wells difficult. An average of 75 sandstones were penetrated in each well, and 6 to 20 are gas productive in each well. The lateral stratigraphic variations provide individual accumulations of limited extent. — HRC

00451 **Sinha, R. N.** Cardium Formation, Edson area, Alberta: Canada Geol. Survey Paper 68-30, 48 p., illus., tables, 1970.

The Cardium Formation of the Edson area includes an oil-producing sandstone body which extends along a northwesterly trend for 12.5 miles, has a maximum width of one mile and a maximum thickness of 15 feet, and is interpreted as an offshore bar with a flat base and a convex top. The Cardium consists mainly of marine sediments

(silty and sandy shales, conglomeratic sandstones, and granule conglomerates) deposited in shallow marine to brackish lagoonal environments associated with progradation of the shoreline. Megafauna recovered from upper beds are referable to the Turonian zone of *Scaphites preventricosus* and *Inoceramus deformis*. At least two thrusts (strike about NW-SE) occur within the area; they were traced through the First White Specks, Bad Heart, and Second White Specks markers, as well as through the top of the Cardium Formation. — *from* Author's abstract

Skehan, James W. *See* Abu-moustafa, Adel A. 00442

08182 **Skinner, Ray, Jr.** Growth of earth science in the secondary schools in Ohio: Ohio Jour. Sci., v. 69, no. 6, p. 371-375, tables, 1969.

A questionnaire survey of secondary-school principals revealed that there were 613 teachers teaching earth science in Ohio during the 1968-69 school year and that there were 50,180 students enrolled in earth science in 410 schools. Most of the schools are located in metropolitan centers in Ohio, but at least one school in 75 of the 88 counties in Ohio offers earth science. This survey revealed that Ohio should rank among the top several states in the number of students enrolled in a standard earth-science course. — Author's abstract

07958 **Skinner, William R.** Geologic evolution of the Beartooth Mountains, Montana and Wyoming — Pt. 8, Ultramafic rocks in the Highline Trail Lakes area, Wyoming, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 19-52, illus., tables, 1969.

Eighteen small, pod-shaped ultramafic bodies associated with granitic gneiss, migmatite, amphibolite, and pegmatite are distributed along a narrow, slightly arcuate zone. The ultramafics are mineralogically complex. The bodies are structurally and chemically similar to alpine ultrabasic rocks and appear to be metamorphic derivatives of a strongly differentiated picrite. Age relations and geographic distribution suggest that these masses are parts of a disrupted, metamorphosed, satellite intrusion of the Stillwater igneous complex. — *from* Author's abstract.

00492 **Slaughter, Bob H.** Evolutionary trends of chiropteran dentitions [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 361-362, 1970.

08144 **Slaughter, Bob H.** *Astroconodon*, the Cretaceous triconodont: Jour. Mammalogy, v. 50, no. 1, p. 102-107, illus., table, 1969.

New fossil material of the only known Cretaceous triconodont *Astroconodon denisoni* Patterson, adds to our knowledge of the form and demonstrates a closer relationship with *Triconodon* than with other Jurassic genera. Comparison of *Astroconodon* with other carnivorous mammalian groups suggests that triconodonts may have been fish-eating, semi-aquatic mammals. The fish faunas associated with *Astroconodon* at five Texas localities tend to strengthen the suggestion. — ESL

Slemmons, David B. *See* Brogan, George E. 00233

00363 **Slemmons, David B.; Firby, James R.** Quaternary folding, warping, and faulting of post Tertiary lacustrine sediments of Owens Lake, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 144-145, 1970.

00364 **Smith, Eugene I.** A pumiceous rhyolite dome, Mono Craters, California — An analog to small lunar cratered cones and relationship to a proposed Mono Craters eruptive sequence [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 145, 1970.

Smith, John Ward. *See* Rohrer, W. L. 07972

07987 **Smith, John Ward.** Geochemistry of oil-shale genesis, Green River Formation, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 185-190, illus., 1969.

The chemical conditions of deposition and the mechanics of deposition postulated for Wyoming's Green River Formation oil shales explain development of oil shale containing relatively large amounts of hydrogen-rich organic matter; uniform, minute, and angular mineral particles; and the existence of the minute annual markings called varves. Lateral persistence of lamina is a natural consequence of the manner of development. — Author's conclusions

Smith, Peter J. *See* Doell, Richard R. 08140

07895 **Smith, Russell.** (editor). Index of geological publications for 1966 donated by societies affiliated or cooperating with the American Association of Petroleum Geologists, prepared by the Committee on Stratigraphic Correlations: Tulsa, Okla., Am. Assoc. Petroleum Geologists, 142 p., 1969.

The compilation consists of three parts: a title index in which publications are listed alphabetically by code, an author index alphabetical according the each author's last name, and a keyword index alphabetized by significant words from titles, text phrases, and figure captions. Guidebooks, maps, cross sections are included with publications of various organizations. — MCM

08084 **Smith, W. E. T.; Milne, W. G.** Canadian earthquakes, 1964: Dominion Observatory Seismol. Ser. 1964-2, 28 p., illus., tables, 1969.

A computer program has been developed which applies the extreme value theorem of statistics to the known seismic history and computes the acceleration corresponding to a given return period (R) at any selected site in eastern or western Canada — that is the acceleration with an average annual probability of 1/R that it will be exceeded. By calculating such accelerations at equally spaced sites and contouring them, seismic zoning maps can be produced. For purposes of earthquake listings, Canada has been divided into four regions: Arctic, Western, Eastern, and Central. Earthquakes of the first three regions are given in tables and epicenters are plotted. During 1964 there was only one earthquake in the Central region. — MCM

07892 **Snavely, Parke D., Jr.; MacLeod, Norman S.; Rau, Weldon W.** Geology of the Newport area, Oregon [Pt. 2], Field trip guidebook — Geol. Soc. America, Cordilleran Sec., 65th Ann. Mtg., Eugene, Oreg., 1969: Ore Bin, v. 31, no. 3, p. 49-71, illus., 1969.

Part I of this article, a geologic sketch of the Newport area, was published in the February issue of Ore Bin. This part is the guidebook for field trips designed to provide a synoptic view of the Tertiary sedimentary and volcanic rocks. The field trip consists of two tours: in the first, the sedimentary rocks exposed along the Yaquina River between Newport and Toledo are examined; tour 2 is concerned with volcanic rocks forming important stratigraphic units in the Coast Range. Geologic sketch maps showing stops are included. — ESL

00365 **Snyder, Henry; Jensky, Wallace.** Mesozoic dike swarms in Baja California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 145-146, 1970.

00366 **Sommer, Michael A.; Garcia, John.** Potassium-argon dates for Pliocene rhyolite sequences east of Puertocitos, Baja California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 146, 1970.

08093 **Spearing, Darwin R.** Stratigraphy and sedimentation of the Paleocene-Eocene Hoback Formation, western Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 65-76, illus., table, 1969.

The formation ranges from middle Paleocene to early Eocene in age and consists of six facies suggesting three depositional environments. A thick sandstone facies, a conglomerate and sandstone facies, and a pebbly sandstone facies suggest stream deposition on an alluvial plain; a flood plain is indicated by a thin sandstone-dark shale, thin sandstone-variegated shale, and a limestone-dark shale facies. The petrography of the sandstones suggests, vertically, progressively deeper erosion of the source area. Cross-stratification measurements suggest a predominant west-to-east sediment transport throughout most of the time; the Snake River Range, west of the Hoback basin, was a likely source for most of the sediments. — *from* Author's abstract

00367 **Speed, R. C.; MacMillan, J. R.** Deformation of the Triassic Augusta sequence, Augusta Mountains, western Nevada [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 146, 1970.

00490 **Spencer, Jean M.** Geological influence on regional health problems [abs.]: Texas Jour. Sci., v. 21, no. 3, p. 337-338, 1970.

00368 **Springer, Robert K.** Plagioclase from the Pine Hill intrusive complex, El Dorado County, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 147, 1970.

07823 **Srivastava, Satish K.** Assorted angiosperm pollen from the Edmonton Formation (Maestrichtian), Alberta, Canada: Canadian Jour. Botany, v. 47, no. 6, p. 975-989, illus., 1969.

Thirty-three species of angiosperm pollen belonging to 20 form genera are described from the Edmonton Formation (Maestrichtian) of Alberta. Three genera, viz. *Nothopollenites*, *Gunnaripollis*, and *Marcellopollenites*, are formally designated here. Twenty-four species are newly described. The stratigraphic occurrence of individual taxa within the Edmonton Formation is indicated. — Author's abstract

07825 **Srivastava, Satish K.** Upper Cretaceous proteaceous pollen from the Edmonton Formation, Alberta (Canada) and their paleoecologic significance: Canadian Jour. Botany, v. 47, no. 10, p. 1571-1578, illus., 1969.

The morphological distinctions between the form genera *Beaupreaidites* and *Proteacidites* are discussed. Also the genus *Beaupreaidites* is suitably emended to accommodate proteaceous colpoid pollen with coarse reticulate, retipilate, or verrucose sexine. Three species belonging to *Beaupreaidites* and three species belonging to *Proteacidites* are reported from the Edmonton Formation. Two new species are described: *Beaupreaidites libitus* and *Proteacidites auratus*. The distribution of proteaceous pollen in Upper Cretaceous strata and their paleoecological significance in the Edmonton Formation are discussed. — Author's abstract

08061 **Stahnke, C. R.; Rogers, J. R., Allen, B. L.** A genetic and mineralogical study of a soil developed from granitic gneiss in the Texas central basin: Soil Sci., v. 108, no. 5, p. 313-320, illus., tables, 1969.

Field evidence, sand fraction ratios, and the qualitative similarity of heavy-mineral suites in all horizons indicate a relatively homogeneous parent material. Chemical, X-ray, and DTA results indicate a mixed clay mineralogy in all horizons. Hydrated iron oxides and randomly interstratified illitic and montmorillonitic units are present in all clays from all horizons. The higher K_2O and lower cation-exchange capacity values of the horizons in the upper solum compared to those deeper in the profile indicate that the clay becomes more illitic with weathering. It is postulated that there is more K available due to more intense weathering; however, recycling of K by vegetation may be a factor. —*from* Authors' summary

00369 **Stanton, Robert J., Jr.** Paleoecology of upper Tertiary basin-margin sedimentary rocks, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 147-148, 1970.

08137 **Statler, Anthony T.; Manning, Robert A.** Recent deep drilling in Tennessee [abs.]: Tennessee Acad. Sci. Jour., v. 44, no. 2, p. 48-49, 1969.

00436 **Stauder, William.** A detailed study of three groups of the smaller aftershocks of the Benham nuclear explosion [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 148, 1970.

Stauder, William. *See* Nuttli, Otto W. 07837

Stearns, Richard G. *See* Ganster, Maurice. 08133

07973 **Steidtmann, James R.** Stratigraphy of the early Eocene Pass Peak Formation, central-western Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 55-63, illus., 1969.

Sediments of the early Eocene Pass Creek Formation were deposited in an intermontane basin flanked on the northeast by the Gros Ventre Range, on the east by the Wind River Range, and on the west by the Hoback and Wyoming Ranges. The basin was filled from the north by quartzite boulders and associated fine clastic sediments derived from the Pinyon Formation and/or its source to the north, and from the east by arkosic sediments derived from the Precambrian core of the Wind River Range. These two dispersal systems coalesced in the central portion of the basin and continued southward. Little, if any debris was shed by the low-standing ranges to the west during the time of deposition of the Pass Peak Formation. — Author's conclusions

Stephenson, Gordon R. *See* Allman, David W. 08096

Stepp, J. C. *See* Algermissen, S. T. 00221

07836 **Stepp, J. C.; Algermissen, S. T.** Preliminary results from a tripartite tiltmeter near Taft, California [abs.]: Earthquake Notes, v. 40, no. 4, p. 17, 1969.

08092 **Sternberg, Yaron M.** Flow to wells in the presence of radial discontinuities: Ground Water, v. 7, no. 6, p. 17-20, illus., 1969.

An analysis is presented for the nonsteady state problem of a well, pumping a constant discharge, and located at the center of a circular aquifer surrounded by a radial discontinuity. On either side of the discontinuity, the transmissibility and the storage coefficient are constant but may have different values from those on the other side of the discontinuity. The solution is obtained by using an approximate inversion formula for Laplace transforms. This method leads to a relatively simple set of equations which commonly require only short computer time for solution. — Author's abstract

00370 **Stevens, Calvin H.** Permo-Pennsylvanian off-shelf deposits, eastern California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 148-149, 1970.

00371 **Stewart, Richard J.** Widespread occurrence of laumontite in the western Olympic Peninsula, Washington [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 149, 1970.

00372 **Stewart, S. W.; Lee, W. H. K.; Eaton, J. P.** Real-time detection of local seismic events by digital computer [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 149-150, 1970.

Stewart, Wilson N. *See* Ramanujam, C. G. K. 08003

08184 **Stock, A. Dean; Stokes, William Lee.** A re-evaluation of Pleistocene bighorn sheep from the Great Basin and their relationship to living members of the genus *Ovis*: Jour. Mammalogy, v. 50, no. 4, p. 805-807, 1969.

Re-examination of the fossil sheep studied by Stokes and Condie (1961), and referred to *Ovis catclawensis*, in light of some critical additional material, including horncores with attached crania and a nearly complete skull, indicates that specimens from lake gravels of the Pleistocene Alpine Formation of the Great Basin are more closely related to *Ovis canadensis* than to *O. ammon* of Asia. Differences in width and length of teeth may be due to tooth wear and bone erosion. The effect of this evidence on theories of migration across the Bering land bridge and evolution of bighorn sheep is discussed. — ESL

08122 **Stoddart, D. R.** World erosion and sedimentation, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 43-64, illus., tables, 1969.

The world total of sediment loss to the sea is 13.6 km^3, or averaged over the surface, 27×10^{-4}m/yr. The figure has little meaning, however, because of the zonal distribution of rainfall and runoff and the azonal distribution of upland areas. The Atlantic Ocean receives 68.5 percent of the world land drainage, the Arctic 44, the Indian 26, and the Pacific only 11. About 30 percent of the eroded material is being deposited in 20 deltas. The deep ocean receives very small amounts of pelagic and terrigenous sediments; the bulk of the sediments are accumulating on the continental shelves and slopes. Some past erosional and depositional rates are shown for the Cenozoic (0.375 $m/10^3$yr), Mesozoic (0.299), late Paleozoic (0.187), and early Paleozoic (0.161). — HRC

08132 **Stoddart, D. R.** Climatic geomorphology, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 473-485, illus., 1969.

Climatic geomorphology rests on the assumptions that different climatic inputs in the denudation system will result in different landform outputs, and that equilibrium landforms will differ between climatic regions in such measurable parameters as drainage density, maximum slope angle, and slope form as well as in the development of characteristic type-landforms. What is needed is data on water availability and temperature conditions at the ground surface and in the weathered mantle, and secondly, some information on the water and sediment outputs from the system. If landform development is viewed as the adjustment of form to process in denudation systems, the emphasis of climate at the expense of the other factors, particularly lithology and structure, is bound to be distorting. — *from* Author's conclusions

Stokes, William Lee. *See* Stock, A. Dean. 08184

Stout, John L. *See* Forgotson, James M., Jr. 07901

00373 **Stout, Martin L.** Stabilization of an active landslide, eastern Puente Hills, Orange County, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 150, 1970.

Stover, Carl W. *See* Tarr, Arthur C. 07839

08149 **Strange, W. E.; Woollard, G. P.** The prediction of gravity in the United States utilizing geologic and geophysical parameters — U. S. Air Force Contract AF23(601)-3879 (Phase III), Final Rept., Pt. 2: Hawaii Inst. Geophysics Rept. HIG-64-18, [81] p., illus., tables, 1964 [1969].

In gravity predictions, large errors relate to geologic parameters; corrections based on a single scale with smaller than 5-mgal increments do not improve accuracy. Important factors in sedimentary basins are basin dimensions, age and type of sediments, depth of burial, and tectonic setting; criteria used are given in detail. Accuracy in prediction of free air anomalies can be significantly improved by correlating with gravity field data geologic and seismic information — the most direct sources of knowledge of types of materials in the solid earth and their densities. Statistical procedures must be developed to include them. In an appendix are tabulated: average elevations and gravity anomalies for 1° × 1° squares, predicted 2 ° × 2°

average modified Bouguer anomalies; predicted 1° × 1° mean free air anomalies for continental United States; 1° × 1° geologic corrections for that region; and 1° × 1° crustal corrections for same. — GDC

Stratton, Lewis P. *See* Price, Vaneaton, Jr. 07870

08107 **Strelkov, S. A.** Main events in the evolution of relief in northern Eurasia and their tentative correlation with those in North America [with German abs.], *in* Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, p. 84-88, illus., 1969.

The latest period of tectonic activity in the Polar Regions of Eurasia and North America was preceded by a period of decreased activity, base-leveling, and river valley formation. Mountains and platforms were uplifted in the Oligocene and Pliocene and valleys were established and later filled by early-Pleistocene deposits. Middle-Pleistocene glaciation affected the relief, and marine transgression began before the glaciation ended. In the northern part of western Siberia are elevated marine coastal plains, and in Europe, Alaska, and parts of eastern Siberia marine sediments occur, covered by recent deposits. Northern Canadian relief was developed under continental conditions. Local tectonic and glacioisostatic movements disturbed the level elements. The last continental glaciation added more depositional relief forms. Flooding occurred in late-glacial times. Terraces were formed in coastal plains and later uplifted. — *from* Author's abstract

00374 **Stull, Robert J.** Feldspars as a guide to the origin of the Golden Horn batholith [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 150-151, 1970.

08039 **Stull, Robert John.** The geochemistry of the southeastern portion of the Golden Horn batholith, Northern Cascades, Washington [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2764B, 1969.

Stupnikova, N. I. *See* Gerassimovsky, V. I. 08167

00449 **Suess, Erwin.** Interaction of organic compounds with calcium carbonate — [Pt.] 1, Association phenomena and geochemical implications: Geochim. et Cosmochim. Acta, v. 34, no. 2, p. 157-168, illus., tables, 1970.

Stearic acid and albumin dissolved in distilled water, as well as lipoid and amino acid-containing substances dissolved in sea water, interact with carbonate mineral surfaces. In sea water, these compounds represent 14 percent of the total dissolved organic carbon which is removed from solution by adsorption processes onto carbonate minerals. The mineral surfaces are saturated with organic carbon after adsorbing 0.1 mg-1.5 mg C per sq m, which is the amount of organic matter needed to form a monomolecular layer. Calcite selectively adsorbs 30-75 percent of the initial concentrations of lipoid material, phospholipids, and amino acid-containing substances. Organo-carbonate associations in sea water appear to reduce reaction rates of inorganic carbonate equilibria and may inhibit reaction entirely if isolation of the mineral by organo-carbonate associations is complete. — Author's abstract

Suito, Eiji. *See* O'Brien, Neal R. 08018

00375 **Suppe, John.** Times of high-pressure metamorphism in the Franciscan terrain of California and Baja California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 151, 1970.

Surdam, R. C. *See* Turner, D. L. 00383

00376 **Surdam, Ronald C.; Turner, Donald L.; Hall, Clarence.** Distribution and genesis of authigenic silicates in the Obispo Formation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 151-152, 1970.

08178 **Swain, F. M.; Prokopovich, N. P.** Biogeochemistry of Delta-Mendota Canal, Central Valley Project, California: U. S. Bur. Reclamation Research Rept. 20 (Water Resources Tech. Pub.), 42 p., illus., tables, 1969.

Unusual clam-bearing sediments and an abundant benthos of amphipods and freshwater sponges on the lining were observed during several dewaterings of the Delta-Mendota Canal. A biogeochemical study of sediments and some organisms showed a relation of organic materials to nutritive condition of the water, pH, Eh, and oxygen content. Canal waters are well aerated. The invert sediments, generally poorly aerated, have negative oxidation-reduction potentials and show reducing conditions. Small amounts of saturated and aromatic hydrocarbons occur in benzene-methanol extracts of sediments and organisms. Large amounts of chlorophyll-derived pigments in canal sediments indicate good preservative conditions. Carbohydrates are low throughout the canal. Protein amino acids and organic acids are plentifully entrapped in sediments, a nutritive source that tends to be lost by decay. Benthonic biomasses as well as sediment masses decrease downstream. — *from* Authors' abstract

00437 **Swain, Frederick W.; Bratt, Judy M.; Kirkwood, Samuel.** Carbohydrates from Precambrian and Cambrian rocks and fossils: Geol. Soc. America Bull., v. 81, no. 2, p. 499-504, 1970.

Carbohydrate residues in 11 samples of early to late Precambrian rocks and fossils and one sample of Middle Cambrian shale ranged from traces to more than 5 micrograms per gram. Various sugars (monosaccharides and a disaccharide) and various polysaccharides (suggesting starch, cellulose, and laminaran) were found. — AG

07806 **Swanson, Earl H., Jr.** Radiocarbon dates for a soil in eastern Idaho: Tebiwa, v. 12, no. 2, p. 58-61, 1969.

Sawmill Canyon, cut in a large alluvial fan of early Quaternary age, is similar to other dissected fans on the northeastern slope of Lemhi Range; across Birch Creek valley, southwest-facing fans coalesce into a well defined piedmont. Artifacts found near a spring perched 7450 feet above sea level, on the shoulder of Sawmill Canyon, are distributed as if settled by weight into soil showing no erosional discontinuities. A composite radiocarbon squence establishes the antiquity of a wetsoil type not common today in the cool desert of the Northern Rocky Mountains; a beginning age of more than 7,700 years corresponds to a regional temperature rise. The uninterrupted soil formation process supports an estimate that Altithermal erosion in eastern Idaho occurred below an altitude of 5,000-6,000 feet. The continuity of this soil, as the only known relic of a weathering episode, modifies the upper boundary of an otherwise useful soil-stratigraphic unit. — GDC

07838 **Syed, Atiq A.** Station corrections for vertical component P wave amplitude at LASA: Earthquake Notes, v. 40, no. 4, p. 51-53, table, 1969.

Station corrections have been established for the long period, vertical component P wave amplitudes for the center of each subarray of the D and F rings at LASA. Data from 56 events have been analyzed. The results suggest that amplitudes recorded at stations F1 and F4 are above average, whereas the amplitudes at stations F2 and D1 are less than the average. There appears to be little dependence on azimuth or the source region. The amplitude variations of long period P waves over LASA are much smaller than those reported by Broone, et al., (1967) for short period P waves. — Author's abstract

00377 **Tabor, R. W.; Cady, W. M.; Yeats, Robert S.** Broken formations and thrust faulting in the northeastern Olympic Mountains, Washington [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 152, 1970.

Takeuchi, Yoshio. *See* Ito, Tei-ichi. 08081

07839 **Tarr, Arthur C.; Stover, Carl W.; Dillinger, William H.** Automated techniques for display of seismological data: Earthquake Notes, v. 40, no. 4, p. 54-56, illus., 1969.

The Seismology Division and Geophysics Research Group of the Office of Seismology and Geomagnetism of the Coast and Geodetic Survey have developed computer programs for plotting seismological data on map projections and have modified a perspective-view computer program supplied by Teledyne. Six global perspective

views have been printed to display selected seismograph stations reporting for the Preliminary Determination of Epicenters program. The seismicity of limited regions can also be shown. Automated plotting of graphical material is becoming an integral part of seismological research at the Coast and Geodetic Survey, because it eliminates the need for very specific base maps, and the high-speed processing of large amounts of data makes possible studies heretofore impossible. — ESL

08063 **Tassonyi, E. J.** Subsurface geology, lower Mackenzie River and Anderson River area, District of Mackenzie: Canada Geol. Survey Paper 68-25, 207 p., illus., tables, 1969.

This study in Northwest Territories between 64°N and Arctic coast, east from Yukon to the Canadian Shield, is based on well samples and on cores and mechanical logs of exploratory wells drilled and on published information prior to March 1961. Subsurface stratigraphy, correlated with surface lithology and nomenclatural history, and described here with some informal units and minor revisions, includes: Cambrian-Silurian (?) formations of the Macdougal Group; seven Devonian formations, restricting Bear Rock Fm. and introducing Gossage Fm.; and four Cretaceous formations. The Tertiary includes tentatively assigned subsurface friable sandstones and silty shales, and sands, gravels, shales and lignite locally overlying the youngest Cretaceous (East Fork) formation. Measured sections and cross sections are presented. The economic potential of each formation is examined, principally with regard to oil and gas. — GDC

Tatlock, D. B. *See* Wallace, R. E. 08154

Tatlock, D. B. *See* Wallace, R. E. 08155

00378 **Tatsch, J. H.** Global seismicity patterns as interpreted in accordance with a dual primeval planet hypothesis [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 153, 1970.

00379 **Terry, Ann.** The Whipple Mountain thrust fault and associated mylonites near Parker Dam, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 153, 1970.

00438 **Theodore, Ted G.** Petrogenesis of mylonites of high metamorphic grade in the Peninsular Ranges of southern California: Geol. Soc. America Bull., v. 81, no. 2, p. 435-449, illus., tables, 1970.

A narrow belt of mylonite gneisses extends 60 miles across southern California. Prominent outcrops of mylonitized prebatholith and batholith rocks occur at Coyote Mountain and record a deformation that is the last plutonic event. Petrographic evidence indicates that the assemblage, sillimanite-K feldspar-muscovite-quartz remained stable or recrystallized during mylonitization and that the $MgCO_3$ content of calcite in deformed marbles indicates a maximum "set" temperature of 580°C. From experimentally studied systems, the physical conditions inferred to exist at the metamorphic peak are T=580-660°C and total P=water P (?)=3.4-7.0 kb.—*from* Authors' abstract

07813 **Theokritoff, George; Thompson, James B., Jr.** Stratigraphy of the Champlain Valley sequence in Rutland County, Vermont, and the Taconic sequence in northern Washington County, New York, Trip 7 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 7-1 — 7-26, illus., 1969.

The Taconic sequence, dominantly Cambro-Ordovician shales with subordinate sandstones and limestones, is juxtaposed with a contemporaneous sequence of sandstone and carbonate rocks. The history of the stratigraphic understanding is reviewed, including the concepts of the two juxtaposed sedimentary basins and that of the Taconic klippe. Eugeosynclinal rocks of Early Cambrian age are recognized, suggesting that the eugeosyncline was established by late Precambrian time. Detailed

sections and a road log for a field trip of 39 miles with 10 stops and another of 16 miles with 13 stops are included. The geology of each stop is described briefly. — HRC

07889 **Thom, Bruce G.** Problems of the development of Isla del Carmen, Campeche, Mexico [with German and English summ.]: Zeitschr. Geomorphologie, new ser., v. 13, no. 4, p. 406-413, illus., 1969.

Isla del Carmen, blocking Laguna de Términos in the State of Campeche, is a complex of three separate barrier islands fused by development of a narrow sand bar, a dune ridge, and mangrove swamps. On the lagoon side of the main inlet, at the eastern end, is a well-developed tidal delta, with main outflow in a deep channel at the western end. Each island has a fan of beach ridges flaring westward, eroded on the Gulf of Mexico side of the eastern and middle sections; farther west is the largest area of beach ridges, not eroded on the Gulf side, but with marked accretion at the extreme end and much less extensive marsh on the lagoon side. Separated by a shallow tidal creek, the western section joins the other two at Bajamito, with an offset of about 300 m; there, an embayment is crossed by a spreading sand spit. Island sediments are mostly carbonate; beneath the innermost ridges lies a calcarenite crust which outcrops along eastern Gulf shores. — GDC

00415 **Thompson, Erik G.; Mack, Lawrence R.** Remarks on paper by J. H. Dieterich and E. T. Onat, 'Slow finite deformation of viscous solids' [1969]: Jour. Geophys. Research, v. 75, no. 8, p. 1625-1627, 1970.

By treating a collapsible viscous material, Dieterich and Onat [ibid., v. 78, no. 8, p. 2081-2088] have developed a technique that enables them to handle a sufficient number of elements to give excellent resolution to the deformed configuration. This in itself is an important contribution. For the finite values of λ/μ to which their procedure is limited, the important qualitative behavioral difference between a Newtonian fluid and the collapsible material makes direct application to geophysical situations involving high hydrostatic pressures, characteristic of most crustal deformation problems, questionable. The practical modifications of their procedure needed in order to treat an incompressible medium are much greater than just 'slight and obvious' ones. Nevertheless, if suitable modifications are made, geophysical applications of the technique should then certainly be significant. — Authors' conclusions

Thompson, James B., Jr. *See* Theokritoff, George. 07813

Thurston, R. N. *See* Fritz, T. C. 00414

Tocher, Don. *See* Hofmann, R. B. 00286

Tocher, Don. *See* Romig, P. R. 00349

Toksöz, M. Nafi. *See* Minear, John W. 00416

Toksöz, M. Nafi. *See* Shlien, Seymour. 08005

07877 **Tozer, D. C.** Electrical conductivity of the mantle, *in* The Earth's crust and upper mantle: Am. Geophys. Union Geophys. Mon. 13 (Natl. Acad. Sci.-Natl. Research Council Pub. 1708), p. 618-621, 1969.

This article is divided into two parts: the first is concerned with geophysical observations and their interpretation in terms of an electrical conductivity of the mantle and the second is a very brief survey of laboratory studies that are thought to be relevant to the further interpretation of the conductivity data in terms of the physical and chemical state of the mantle. — Author's abstract

Tracey, Joshua I., Jr. *See* Ladd, Harry S. 07894

00380 **Trifunac, M. D.; Hudson, D. E.** Analysis of the station no. 2 seismoscope record — 1966, Parkfield, California, earthquake [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 153-154, 1970.

08112 **Tri-State Geological Field Conference; Sendlein, Lyle V. A.; Vondra, Carl F.** (coordinators). The many faces of geology — 33d annual Tri-State [Geological] Field Conference, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, 76 p., illus., 1969.

This guidebook to the field trip of the 33rd Tri-State Geological Field Conference, October 17-19, 1969, sponsored by Iowa State University, includes road logs for the field trip between Ames and Webster City, as well as 9 papers (cited sparately) on the geology of the area, including maps and illustrations. — EH

08176 **Troell, Arthur R.** Depositional facies of Toronto Limestone Member (Oread Limestone, Pennsylvanian), subsurface marker unit in Kansas: Kansas Geol. Survey Bull. 197, 29 p., illus., tables, 1969.

This member at the base of the Oread Limestone, exposed in southeastern Nebraska and northwestern Missouri, can be traced across eastern Kansas, grading southward into shale in Oklahoma. A thin *Osagia* algal oncolite zone, the strand-line record of a transgressing sea, is at its base over much of northern and central Kansas, covered by a skeletal wackestone with open-marine fauna which extends into Oklahoma and Nebraska; its three subfacies reflect local conditions during an inundative sea stand. From central Kansas northward, at top of the Member, is lime mudstone with molluscan fauna, a shallow subtidal to tidal-flat deposit of regression. The Toronto Limestone facies seem not to represent definite stages of transgression and regression; stratigraphic relationships, similar to those in the Recent carbonate sequence of the Great Bahama Bank, suggest a eustatic change in sea level as the controlling mechanism during deposition. — *from* Author's abstract

00381 **Troxel, Bennie W.** Anatomy of a fault zone, southern Death Valley, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 154, 1970.

00421 **Tschudy, Robert H.** Two new pollen genera (Late Cretaceous and Paleocene) with possible affinity to the Illiciaceae: U. S. Geol. Survey Prof. Paper 643-F, p. F1-F13, illus., table, 1970.

Palynological examination of Upper Cretaceous and Paleocene samples disclosed several pollen species that are commonly found as isolated thirds, rather than complete specimens. Two new fossil pollen genera, *Terscissus* and *Trisectoris*, are described for these pollen species. Three new species are included in the genus *Terscissus* and two new species are assigned to the genus *Trisectoris*. Four unnamed species belonging to the genus *Terscissus* and two to the genus *Trisectoris* are discussed and figured. Comparison is made with some species of the modern genus *Illicium*, which also possess the tendency to separate into three isolated segments. All the species in these two genera are from rocks of Late Cretaceous and Paleocene age. The stratigraphic range of each species is shown. — Author's abstract

00382 **Turner, D. L.; Curtis, G. H.; Berry, F. A. F.; Jack, R. N.** Age relationship between the Pinnacles and Parkfield felsites and felsite clasts in the southern Temblor Range, California — Implications for San Andreas fault displacement [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 154-155, 1970.

00383 **Turner, D. L.; Surdam, R. C.; Hall, C. A.** The Obispo Formation and associated volcanic rocks in the central California Coast Ranges — K-Ar ages and biochronologic significance [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 155, 1970.

Turner, Donald L. *See* Surdam, Ronald C. 00376

08159 **Turner, Francis J.; Ulbrich, Mabel.** Comparison of lunar with terrestrial and meteoritic rocks: Natl. Acad. Sci. Proc., v. 64, no. 3, p. 1016-1020, table, 1969.

Recent attempts to identify or closely correlate lunar surface samples on the basis of alpha-scattering analysis, with terrestrial basalts or eucrite meteorites, are examined. Basalts all have chemical characteristics inherited from terrestrial mantle rock melted under a limited range of terrestrial pressure-temperature conditions. The criterion that might be useful in comparing terrestrial basalt with extraterrestrial rocks is not so much the content of an element or oxide, but a pattern in which ratios like Fe/Mg and Ca/(Na+K) show consistent relationships to Si content. Turkevich's analysis of alpha-scattering data for lunar samples shows significant departure from basaltic composition. The same "lunar" pattern appears in recorded analyses of eucrite meteorites. In lunar samples, Ti is higher than in basalts, and even higher than in eucrites. — *from* Authors' abstract

Tuttle, O. F. *See* Luth, W. C. 07968

07884 **U. S. Geological Survey.** (compiler). Annual report on ground water in Arizona, spring 1968 to spring 1969: Arizona Land Dept. Water-Resources Resources Rept. 42, 46 p., illus., tables, 1969.

For many years nearly two-thirds of Arizona's water supply has been withdrawn from the ground-water reservoirs, the principal use being for irrigation. Knowledge of storage capacity of aquifers and factors controlling transmission of water are important in protecting water supplies. This report summarizes water levels in selected wells and estimated ground-water pumpage in most developed areas. Ground water occurs under different conditions in each of the three water provinces — Basin and Range lowlands, Central highlands, and Plateau uplands. — MCM

07933 **Uchupi, Elazar.** Morphology of the continental margin off southeastern Florida: Southeastern Geology, v. 11, no. 2, p. 129-134, illus., 1969.

A [bathymetric] chart of the continental margin off southeastern Florida displays in considerable detail the surface morphology of the margin. Topographic features on the chart are believed to be due to reef buildup during the Tertiary, deposition on the shelf along former strand lines during the Pleistocene when sea level was lower than now, erosion by the Gulf Stream and deposition and shaping by bottom currents. — Author's summary

Uken, E. A. *See* Wainerdi, R. E. 07993

Ulbrich, Mabel. *See* Turner, Francis J. 08159

00426 **Underwood, James R., Jr.** Steeply dipping strata, Marion County, Florida: Florida Acad. Sci. Quart. Jour., v. 32, no. 2, p. 99-107, illus., 1969 [1970].

Steeply dipping beds associated with a small asymmetrical anticline in the Eocene Ocala Limestone are exposed in a quarry north of Ocala. Several possible modes of origin of the deformation are discussed. The presence of nearby minor faults and the gross geometry of the deformed strata suggest drag along a small high-angle fault; an alternative possibility is subaqueous slumping. Both explanations, however, require the presence of a plane or zone along which differential movement could take place; there is no visible evidence of such a plane. — VMJ

00384 **Unger, John D.; Eaton, Jerry P.** Aftershocks of the October 1, 1969, Santa Rosa, California, earthquakes [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 155, 1970.

08040 **Unger, John Duey.** The microearthquake activity of Mt. Rainier, Washington [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 6, p. 2765B, 1969.

Vagners, Uldis J. *See* Dreimanis, Aleksis. 08174

Valdes, Sylvia. *See* Boström, Kurt. 07930

00385 **Valentine, James W.; Conoboy, John T.** Genetic strategies associated with resource regimes and their effects on taxonomic diversity in the fossil record [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 156, 1970.

00386 **Valentine, James W.** How many marine invertebrate fossil species — A new approximation [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 156, 1970.

07773 **vanderBent, E. Th.** Dip estimation for photogeology: Photogramm. Eng., v. 35, no. 12, p. 1225-1227, illus., table, 1969.

Since height exaggeration interferes with true dip assessment, a summary of the geometrical considerations in H. J. Fichter's 1954 paper dealing with height exaggeration is given. In 1964 the author developed a simple stereo dip comparator (herein described), allowing direct visual comparison of a natural dip slope against a range of constructed dip slopes in one stereo image. —ESL

VanWormer, J. D. *See* Romig, P. R. 00349

07941 **Veatch, Fred M.** Analysis of a 24-year photographic record of Nisqually Glacier, Mount Rainier National Park, Washington: U.S. Geol. Survey Prof. Paper 631, 52 p., illus., table, 1969.

Systematic coverage of the glacier by photographs taken from a network of about 20 stations was begun in 1942 to explore the value and limitations of such photographs in glacier study. Results were compared with those from available engineering studies. Photographs show that most of the ice thickness lost between 1890 and 1944 along the west margin for a mile below Wilson Glacier has been recovered. Withering of a stagnant valley tongue down glacier from the nunatak and its spectacular reactivation in the 1960's is portrayed. Annual values of the glacier's surface slope were measured on photographs and averaged about 2 degrees less than from topographic maps. Annual changes in thickness at two locations were determined and agree with stadia surveys. Position of the snowline, sources of debris, medial moraines, crevassing, erosion of canyon walls, and effects of the 1932 and 1955 outburst floods were also studied. — *from* Author's abstract

08080 **Villalobos, Crescencio Ignacio.** Nueva carta hidrogeoquímica del Estado de San Luis Potosí: Potosí Univ. Autónoma Inst. Geología y Metalurgia Fol. Téc. 19, 6 p., illus., 1969

By using DTH (Hydrochemical triangular diagrams) in preparing hydrogeochemical and hydrogeologic maps, the basic composition of water can be presented in an integral manner, rather than partially showing predominant elements and salts as previously done. The importance of this map, compared to the preliminary hydrochemical map, lies not only in the classification made of the waters in San Luis Potosí, but in possibly developing both systems for the elaboration of hydrogeochemical maps in any region, state or country. The ease with which these maps can be reproduced in lantern slides or microfilm, even with the multitudes of data that can be put on a map, provides a simple way to sum up and store results of extensive studies. — GDC

07846 **Vincent, Jerry W.** Biostratigraphy of the Fredericksburg Group in Bosque County, Texas [abs.]: Texas Jour. Sci., v. 20, no. 3, p. 291, 1969.

07777 **Voight, Barry; Samuelson, Alan C.** On the application of finite-element techniques to problems concerning potential distribution and stress analysis in the Earth sciences: Pure and Appl. Geophysics, v. 76, p. 40-55, illus., table, 1969.

The elastic response has been determined by structural matrix analysis for a homogeneous rock layer subjected to two-dimensional distributions of vertical displacement applied along a basal boundary. The results obtained compared favorably with biharmonic function solutions. The effects of (1) different magnitudes of superposed gravitationally-induced stresses, (2) release of a constrained side boundary, and (3) introduction of pronounced heterogeneity were analyzed and found to cause important changes in (1) configuration of stress trajectories, (2) predicted locations and configurations of initial fracture surfaces, (3) shear stress distributions, and (4) displacement fields. The application of finite-element analysis to the following problems is discussed: behavior of rocks under static/dynamic loading, seismic response, heat and fluid flow, and distribution of potential. — GV

Vondra, Carl F. *See* Tri-State Geological Field Conference. 08112

Vondra, Carl F. *See* Peterson, Ronald M. 08117

Vondra, Carl F. *See* Johnson, Gary D. 08118

08119 **Vondra, Carl F.** The Cedar Valley Formation, Palo Quarry, *in* The many faces of geology — Tri-State [Geol.] Field Conf., 33d, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, p. 73, 1969.

This article describes briefly a bioherm from the Cedar Valley Formation of the Middle Devonian, from Palo Quarry in central eastern Iowa. — EH

08171 **Vondra, Carl F.** Lime Creek Formation, Cerro Gordo Member, Rockford Brick and Tile Company Quarry, *in* The many faces of geology — Tri-State [Geol.] Field Conf., 33d, Ames, Iowa, 1969: Iowa State Univ. Dept. Earth Sci. Pub. 2, p. 73, 1969.

This article describes briefly the Juniper Hill and Cerro Gordo Members of the Lime Creek Formation as represented in the Rockford Brick and Tile Company Quarry in central northern Iowa. — EH

Voss, J. D. *See* Brookins, D. G. 00462

Vreeken, W. J. *See* Allen, W. H., Jr. 08170

Waddell, K. M. *See* Hood, J. W. 07888

Waddell, K. M. *See* Hood, J. W. 07893

07896 **Wagner, Frank S., Jr.** Composition of the dissolved organic compounds in seawater — A review: Contr.Marine Sci., v. 14, p. 115-153, tables, 1969.

A review has been made of the chemical individuals and types of compounds that have been identified, isolated or reported present in seawater. Improvements in methods for determining the composition of the dissolved organic compounds may be new tools for ecological investigations. There are a few rapid, simple and accurate procedures suitable for large-scale surveying of seawaters. Evidence supporting Lucas' hypothesis of the role of dissolved organic compounds in seawaters may now be considered overwhelming. — Author's abstract

00387 **Wagner, J. Ross.** Late Cenozoic deformation in the central Coast Ranges, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 156-157, 1970.

00388 **Wahrhaftig, Clyde.** The trouble with the rate of erosion [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 157, 1970.

Wai, Chien M. *See* Wasson, John T. 00478

07993 **Wainerdi, R. E.; Uken, E. A.; Santos, G. G.; Yule, H. P.** Neutron activation analysis and high resolution gamma-ray spectrometry applied to areal elemental distribution studies, *in* Nuclear techniques and mineral resources — Symposium, Buenos Aires, 1968, Proc.: Vienna, Austria, Internat. Atomic Energy Agency, p. 507-533, illus., tables, discussion, 1969.

The applicability of automated, instrumental thermal neutron activation analysis techniques to large-scale areal elemental distribution determinations related to continental drift and to metallogenesis is examined. The Enchanted Rock batholith, Llano, Texas, was selected as an initial area on the basis of availability of independent geochemical information. Rock samples include points from areas outside the batholith. Results indicate continuous trends in each trace element, through various rock types, over a distance of greater than 50 miles. Trace elements of pyrite, chalcopyrite, and sphalerite obtained from the Philippine Islands were measured to apply the procedure to minerals in an area where their areal extent has not been previously studied. — *from* Authors' abstract

07961 **Walker, Kenneth R.** A mineralogical, petrological, and geochemical investigation of the Palisades Sill, New Jersey, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 175-187, illus., tables, 1969.

Detailed studies of the Palisades Sill have revealed new information on its mineralogy, particularly on relations between pyroxenes and olivine in late fractionation stages, beyond the two-pyroxene field in the pyroxene quadrilateral. Chemical investigation identified the sill as a multiple intrusion containing two main magma phases. Geochemical study of element distribution, and behavior with fractionation in tholeiitic magma, indicated the importance of fractional crystallization in differentiation. The degree of differentiation was largely controlled by the rate of cooling, for this determined the contribution by gravity settling in early stages of crystallization and extent of fractional crystallization possible throughout cooling. Differentiation was toward iron- , silica- , and alkali-enrichment; range and trend are similar to other tholeiite provinces. — *from* Author's abstract

00422 **Walker, Myrl V.** George Fryer Sternberg, August 26, 1883-October 23, 1969: Soc. Vertebrate Paleontology News Bull. 88, p. 77, 1970.

08154 **Wallace, R. E.; Tatlock, D. B.; Silberling, N. J.; Irwin, W. P.** Geologic map of the Unionville quadrangle, Pershing County, Nevada: U. S. Geol. Survey Geol. Quad. Map GQ-820, scale 1:62,500, sections, 1969.

08155 **Wallace, R. E.; Silberling, N. J.; Irwin, W. P.; Tatlock, D. B.** Geologic map of the Buffalo Mountain quadrangle, Pershing and Churchill Counties, Nevada: U. S. Geol. Survey Geol. Quad. Map GQ-821, scale 1:62,500, sections, 1969.

Walper, Jack. *See* Kuehn, Jack. 00488

08126 **Waltz, J. P.** Ground water, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 259-267, illus., table, 1969.

This is a generalized summary of the nature and occurrence of ground water. Portions devoted to definitions, occurrence (in the porosity and permeability sense), aquifers, and earth materials (consolidated and unconsolidated) are discussed. Geologic factors which control the occurrence of water, such as stratigraphy and structure, are also briefly described. Since ground water is always in motion, a portion of the work is devoted to Darcy's law and its development. — HRC

Warman, James C. *See* Scarbrough, W. Leon. 07789

08048 **Warnke, Detlef A.** Pediment evolution in the Halloran Hills, central Mojave Desert, California [with German and English summ.]: Zeitschr. Geomorphologie, new ser., v. 13, no. 4, p. 357-389, illus., table, 1969.

Davisian geomorphic stages in the Halloran Hills, indicative of an arid cycle of erosion in individual mountain ranges, are proposed: initial, intermediate, advanced, and final. All hill complexes here are intermediate, Double Dome advanced; pediments are extensive only on quartz monzonite, minor on metamorphic rocks. The terms *conohelical pediment* and *pediment scarp* are proposed. Downcutting is quantitatively the most important process, then lateral corrasion in nongranitic hill complexes; temporary base levels, regardless of site, lead to dissected pediments only. Cause is not necessarily tectonism or climatic change; but, in the Baker area is uplift and suitable rock type. Quartz monzonite lacks protection of desert varnish; in disintegration its mineral-stability series is in reverse. The modern arid cycle of erosion was initiated before Pleistocene time; ice-age pluvial interruptions did not significantly change landform evolution. — GDC

08052 **Washburn, A. L.** Weathering, frost action, and patterned ground in the Mesters Vig district, Northeast Greenland: Medd. Grönland, v. 176, no. 4, 313 p., illus., tables, 1969.

This report is one of a series of geomorphic and vegetational studies on the Mesters Vig area. Chemical weathering is locally important, with hydration the most widespread and effective process. Aside from scattered prying by roots of woody plants, frost wedging is the most common physical weathering process. Frost action processes comprise: frost cracking, frost heaving, mass displacement, density and intergranular pressure changes and, possibly, cryostatic pressure. Some of these processes produce sorting. Permafrost is widespread and pingos common along some drainages. Patterned ground is common in moist locations, especially small and large nonsorted and sorted patterns. Using a genetic grouping of pattern forms, the basic processes occurring at Mesters Vig were: desiccation cracking, frost cracking, sedimentation, mass displacement, rillwork, differential mass-wasting, frost wedging and heaving. Conclusions support the polygenetic origin of many similar and dissimilar forms of patterned ground. — *from* Author's abstract

00461 **Washburn, Robert H.** Paleozoic stratigraphy of Toiyabe Range, southern Lander County, Nevada: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 2, p. 275-284, illus., 1970.

Sedimentary rocks of Cambrian to Carboniferous age in the Toiyabe Range were deposited in a transitional zone between miogeosynclinal and eugeosynclinal belts. The Lower Cambrian Gold Hill Formation is as much as 3,250 feet thick and consists of quartzite, graywacke, and limestone. The Cambro-Ordovician Broad Canyon Formation (new name) comprises limestone, siltstone, and phyllite, and is about 2,000 feet thick. The Antelope Valley Limestone, as much as 800 feet thick, contains Middle Ordovician fossils. The Silurian Masket Shale disconformably overlies the Antelope Valley Limestone. A limestone containing Devonian corals overlies the Masket Shale. Limestone and chert from the Carboniferous Wildcat Peak Formation are in a Tertiary conglomerate. An allochthonous sequence, tectonically above the transitional succession, is about 10,000 feet thick and consists of Paleozoic chert and argillite. — EAM

08139 **Wasilewski, P. J.** Thermochemical remanent magnetization (TCRM) in basaltic rocks — Experimental characteristics: Jour. Geomagnetism and Geoelectricity, v. 21, no. 3, p. 595-613, illus., table, 1969.

Basaltic rocks with optically homogeneous titanomagnetites have common magnetization characteristics and can be termed magnetic class I rocks; all exhibit thermochemical remanent magnetization (TCRM) behavior when heated. In the study of the TCRM process reported here, it is shown that the temperatures at which experiments are conducted will control results. The experiments provide general relations for magnetization behavior of magnetic class I rocks which will hold if the magnetic parameter is measured at room temperature after being heated at each of several higher temperatures in a stepwise fashion. Heating of this class of rocks results in increase in Curie point, saturation magnetization, susceptibility, coercive force, remanent magnetization, and demagnetization stability. Thermal, thermochemical, and oxidation processes operative in development of TCRM in basaltic rocks will be examined in detail in a future study. — VSN

08141 **Wasilewski, P. J.** Thermomagnetic analysis — Experimental factors: Jour. Geomagnetism and Geoelectricity, v. 21, no. 3, p. 655-667, illus., 1969.

Thermomagnetic analysis along with conventional reflection microscopy and magnetic powder analysis can be used to evaluate the alteration state of the magnetic fraction in a rock. The alteration state is positive or negative depending on the sense of change in a magnetic parameter observed during thermomagnetic analysis. Grain size, sample preparation, experimental atmosphere, and heating rate are factors which must be considered in interpreting results of thermomagnetic analysis. The effects of experimental factors are more pronounced in basic than in acidic rocks because of the greater amount of titanium and other cations in the iron oxides. They are likewise more pronounced in extrusive than in intrusive basic rocks because of

the more variable cooling conditions and smaller more chemically heterogeneous iron oxides. — *from* Author's abstract

00478 **Wasson, John T.; Wai, Chien M.** Composition of the metal, schreibersite and perryite of enstatite achondrites and the origin of enstatite chondrites and achondrites: Geochim. et Cosmochim. Acta, v. 34, no. 2, p. 169-184, illus., tables, 1970.

Electron-microprobe analysis of Si, P., and Ni in the metal grains and associated schreibersite and perryite of eight enstatite achondrites shows that the compositions of these phases are relatively constant within a given meteorite, but show substantial variations between meteorites. A tentative sequence among these achondrites on the basis of the Si concentrations in the metal is defined. It is suggested that enstatite chondrites and achondrites form a single evolutionary sequence, all members of which were produced in the same process or processes occurring in the solar nebula prior to accretion. — GV

Watson, K. D. *See* Morton, D. M. 00320

Weaver, D. W. *See* Fairchild, W. W. 08015

Weichert, D. H. *See* Basham, P. W. 00417

Weide, David L. *See* Orme, Antony R. 00330

Welday, E. E. *See* Baird, A. K. 00226

00456 **Wellmer, Friedrich-Wilhelm.** Der US Geological Survey [The U.S. Geological Survey]: Erzmetall, v. 23, no. 1, p. 34-39, illus., 1970.

The purpose of the U.S. Geological Survey, its organization, the work of the various divisions (Geologic, Conservation, Water Resources, Topographic), special research programs (heavy metals and earth resources observation satellite), geologic activity abroad, and the Office of Minerals Exploration are described briefly, on the basis of Wellmer's acquaintance during a year's study and research in the United States. — DBV

07871 **Welte, Dietrich H.** Determination of C^{13}/C^{12} isotope ratios of individual higher n-paraffins from different petroleums [with German abs.], *in* Advances in organic geochemistry 1968 — Internat. Mtg., 4th, Amsterdam, 1968, Proc.: Oxford, England, and New York, Pergamon Press (Internat. Ser. Mons. Earth Sci., V. 31), p. 269-277, illus., 1969.

A method for collecting individual higher n-paraffins from petroleums for C^{13}/C^{12} isotope analysis has been developed. Quartz tubes filled with carbon-free molecular sieves type 5A are attached directly to the exhaust port of a gas chromatograph and individual n-paraffins are collected in different tubes. The tube is then transferred to a combustion line. Carbon isotope ratios of the resulting CO_2 are determined in a mass spectrometer. In the three petroleums studied the individual n-paraffins $n\text{-}C_{17}$ to $n\text{-}C_{33}$ exhibited among themselves differences up to 1 per mille $\delta\ C^{13}/C^{12}$. All three distribution curves of the isotope ratios show a minimum in the range from 27 to 31 C-atoms. These minima are tentatively interpreted to represent a higher concentration of biologically produced carbon skeletons in this particular molecular weight range. — Author's abstract

08086 **Wengerd, Sherman A.** Western Paradox basin is a potential oil giant in Pennsylvanian rocks, Pts. 1-3: Oil and Gas Jour., v. 68, no. 4, p. 172, 174, 176, 183-184; ibid., no. 5, p. 142-143, 146-147; ibid, no. 6, p. 96-97, 100-102, illus., tables, 1970.

The western Paradox basin in southeastern Utah is in the northern Colorado Plateau on a structural saddle between the San Rafael swell, the Monument upwarp, the Paradox fault-fold belt, and the Henry Mts. Following a brief review of the history and techniques of exploration of this area, the geologic framework, stratigraphy, unconformities, structures, and petroleum exploration are summarized. — VSN

Wesendunk, P. R. *See* Fairchild, W. W. 08015

00389 **West, Robert M.** Distribution and correlative importance of the early Tertiary Phenacodontidae (Condylarthra — Mammalia) [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 157-158, 1970.

07974 **West, Robert M.** Geology and vertebrate paleontology of the northeastern Green River Basin, Wyoming, *in* Symposium on Tertiary rocks of Wyoming — Wyoming Geol. Assoc., 21st Field Conf., 1969, Guidebook: Casper, Wyo., Petroleum Inf., p. 77-92, illus., 1969.

Three tongues of the lacustrine lens of the Eocene Green River Formation are present in the New Fork-Big Sandy area of the Green River Basin: the Fontanelle at the base, a middle tongue, and the upper Laney Shale Member. The Wasatch Formation is represented by the New Fork Tongue, which contains 30 mammalian taxa in an eastern facies (here listed), and 22 taxa in a western facies (here listed); the overlying Cathedral Bluffs Tongue contains 15 mammalian taxa. The Bridger Formation rests on the Wasatch, and the lower fluvial portion contains 46 mammalian taxa; the upper portion is not present in the area but is nearby. Pleistocene deposits overlie the Eocene rocks. The Wind River thrust fault was the major source of structures in the basin. The faunas are correlated with others around the United States. — HRC

00476 **Weyl, Peter K.** Oceanography, an introduction to the marine environment: New York and London, John Wiley and Sons, 535 p., illus., 1970.

This textbook explores how the ocean has stabilized the Earth's surface environment, why it is deep, mechanism that made the configuration of the sea floor, and interactions of organisms. The six parts each contain several chapters: (1) perspectives — man and the Earth, history of life on Earth, history of oceanography, mapping the Earth; (2) Earth as a heat engine; (3) Earth beneath the sea — relief of the ocean, denudation of continents, moving shoreline, margins of continents, ocean basins, continental drift; (4) salt of the sea — water, the universal solvent; river water and sea water; carbonate cycle; geological history of sea water; (5) life in the sea; and (6) marine environment. A bibliography and an index are appended. — MCM

00466 **White, Gerald T.** California's other mineral: California Div. Mines and Geology Mineral Inf. Service, v. 23, no. 2, p. 23-33, illus., 1970.

Unlike gold, California oil has had only marginal notice from historians; early reports of seeping tar used by the Indians for centuries were mentioned by explorers of 200 years ago near the Brea Tar Pits and Santa Barbara Channel in the present-day Los Angeles area. Four of the six largest American fields in cumulative production are in California, the state responsible for more than one-sixth of the nation's oil. Statistics of development in the first quarter of the 20th century are reviewed, with emphasis on effects on life and industry in this state. California's universities have played a large role in training scientific leadership in the oil industry; and many agents in government services became independent consultants. Since discovery of the giant East Texas field in 1930, the ratio of production has declined in California. — GDC

07909 **Whitten, E. H. Timothy.** Trends in computer applications in structural geology, *in* Computer applications in the earth sciences (D. F. Merriam, editor) — Conf., Univ. Kansas, 1969, Proc.: New York and London, Plenum Press, p. 223-249, 1969.

Published work on the few attempts to exploit usefulness of computers to structural geology include: storage and collation of structural observations, computation of generalized properties, descriptions of fold morphology, and mapping and analysis of spatial variability of structural elements. Obvious potentialities include development of programs that permit: identification of multiplicity of geological factors controlling nature and spatial variability of fold geometry, objective evaluation of relative importance of identified controlling geological factors, and erection of process-response models to permit simulation of fold systems and objective comparison of such simulations with actual fold systems. — *from* Author's abstract

Wideman, C. J. *See* Romig, P. R. 00349

07857 **Wigginton, William B.** Bay mud—Why does it have such a bad reputation?, *in* Urban environmental geology in the San Francisco Bay region (E. A. Danehy and R. C. Harding, editors): Sacramento, Calif., Assoc. Eng. Geologists, p. 75-81, illus., table, 1969.

Bay mud has a bad reputation for a good reason. However, by use of the modern techniques of soil mechanics, land is being safety reclaimed and well-designed structures are being placed on the material or in some cases even in the material (for example, the Bay Area Rapid Transit District Bay Tube). The engineering geologist can be of real service in these efforts in respect to providing: correlations and subsurface contours of the sediments on an areal basis, geophysical subbottom profiling, and input data for the study of the seismic behavior of the mud. — Author's conclusions

08136 **Wilcox, J. T.; Hershey, Robert E.** Mineralogy of heavy mineral sands from selected localities in West Tennessee [abs.]: Tennessee Acad. Sci. Jour., v. 44, no. 2, p. 49, 1969.

07784 **Wilhelmy, Herbert.** Alexander von Humboldt in the light of his American journey: Universitas (Wissenschaftliche Verlagsgesellschaft, Stuttgart, Germany), v. 12, no. 1, p. 37-52, 1969.

08127 **Williams, Paul W.** The geomorphic effects of ground water, *in* Water, Earth, and Man (R. J. Chorley, editor): London, Methuen and Co. Ltd. (distributed in USA by Barnes and Noble, New York), p. 269-284, illus., 1969.

Karst landscapes are largely the result of solution on the surface and underground, plus collapse induced by solution. The dimensional characteristics and spacial distribution of karst landforms are being quantitatively described, and a sensible if complex arrangement of features is being revealed — not the utter chaos once ascribed to karst. The techniques involved in this analysis are in the early stages of development, and many possible interrelationships remain to be tested. The problems of isolating and quantifying the landform responses to percolation solution, vadose stream action, and phreatic water solution are very great, and indeed, attempts to do so are rather premature at this stage of karst morphometry, when general patterns and the full range of related landforms have not yet been adequately described. — *from* Author's conclusions

Williams, R. S., Jr. *See* Neal, J. T. 07770

Williams, R. S., Jr. *See* Gawarecki, S. J. 07771

Williams, Roy E. *See* Allman, David W. 08096

07962 **Wilshire, H. G.** Mineral layering in the Twin Lakes Granodiorite, Colorado, *in* Igneous and metamorphic geology — A volume in honor of Arie Poldervaart: Geol. Soc. America Mem. 115, p. 235-261, illus., tables, geol. map, 1969.

The intrusion is composed mainly of coarse-grained porphyritic granodiorite, and is zoned from a felsic core to a slightly more mafic border. Steeply dipping mineral layers, a few to 5 inches thick and several tens of feet long, occur in marginal zones up to 5,000 feet wide. Four main types of layers are defined by increased abundances of orthoclase, quartz, plagioclase, and mafic minerals. Textural evidence indicates that the magma contained 50 to 60 volume percent suspended crystals during emplacement; structures in mafic layers superficially resemble sedimentary structures, but are consistent with flow sorting processes accompanied by deformation. The layering probably formed by size sorting of the suspended crystals in marginal zones of the intrusion by vertical shear flow during emplacement. — *from* Author's abstract

08057 **Wilson, Charles W., Jr.** Geologic map of the Leatherwood quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 33-NE, scale 1:24,000, separate text, 1969.

Mined mineral resources of the Leatherwood quadrangle are: chert for road metal from the Fort Payne Formation; limestone for aggregate, road metal, and agricultural limestone from the Decatur, Lego, and Laurel limestones; and sand and gravel for roads from alluvial deposits. A potential resource is phosphate. — MCM

07945 **Wilson, Kenneth C.** Comments on "Sediment transport in conveyance systems" [by W. H. Graf and E. R. Acaroglu, 1968]: Internat. Assoc. Sci. Hydrology Bull., v. 14, no. 4, p. 131-134, 1969.

Wilson calls attention to Graf and Acaroglu's [ibid., v. 13, nos. 2 and 3, 1968] definition of the hydraulic radius which appears in the parameters Φ and Ψ (dimensionless transport parameter and shear intensity parameter, respectively). They have used the "overall" hydraulic radius, i.e. waterway area divided by wetted perimeter, whereas it is normal in sediment transport work to use a "bed-associated" hydraulic radius because of its rational basis and because it reduces scatter of results. Various other details of the experiments are examined critically. — VSN

Winchell, Robert E. *See* Ehrreich, Albert L. 00258

Winchell, Robert E. *See* Ehrreich, Albert L. 00259

Windley, B. F. *See* Herd, R. K. 08161

07996 **Winterer, Edward L.; Hawkins, James W.; Matthews, Jerry L.; Allison, E. C.** Inverted metamorphic zonation of Franciscan rocks of the California borderland — Possible relation to Mesozoic continental underthrusting [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 7, p. 240-241, 1969.

Wire, Jeremy C. *See* Page, Leo M. 07798

Wise, W. S. *See* Moores, E. M. 00318

Wolf, Stephen C. *See* Scholl, David W. 00359

07821 **Wolff, Manfred P.** The Catskill deltaic complex — Deltaic phases and correlations of the Middle Devonian Marcellus Formation in the Albany region, Trip 20 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 20-1 — 20-41, illus., 1969.

The faunal control in various measured sections, in association with the recognition of distinct deltaic phases and their vertical and lateral variations, provide an understanding of the tectonic framework for the deposition of the various Marcellus members. The Catskill delta is almost entirely constructional. The turbidite sequences in the Chagrin phase have permitted identification of density currents on gentle slopes, and hence long-range correlations of deltaic units become possible. A new classification of the Marcellus members is proposed. The guidebook for a trip of 175 miles includes 10 well-described stops. — HRC

Wollenberg, H. A. *See* Dodge, F. C. W. 00255

08145 **Woodburne, Michael O.** A late Pleistocene occurrence of the collared peccary, *Dicotyles tajacu*, in Guatemala: Jour. Mammalogy, v. 50, no. 1, p. 121-125, illus., 1969.

This specimen, a right maxillary fragment, represents the earliest record of the species of which the author is aware, and also represents an extension of the geographic range; it was collected from a playa in the middle of the Río de la Pasión, near Santa Amelia, Petén, at low water. The maxillary fragment is described and illustrated. Dimensions of the upper cheek teeth are compared with a Recent series of *Dicotyles tajacu*. It seems probable that the lineage leading to the collared peccary underwent most, if not all, of its evolution in South America. — ESL

Woodward, Thomas C. *See* Hicks, Merle E. 07984

Woollard, G. P. *See* Strange, W. E. 08149

08104 **Wright, H. E., Jr.** (editor). Quaternary geology and climate — Internat. Assoc. Quaternary Research, 7th Cong., Proc., V. 16: Natl. Acad. Sci. Pub. 1701, 162 p., illus., tables, 1969.

This compilation consists of 23 papers presented at the 7th Congress of the International Association for Quaternary Research in Boulder, Colorado in 1965, under the joint sponsorship of the National Academy of Sciences and the National Research Council. Introductory remarks by H. E. Wright, Jr. are followed by the papers grouped into sections devoted to climatic change, glacial, nonglacial, and coastal geology. Ten articles are cited separately. — EH

00390 **Wright, Robert H.** Paleoecology and zoogeography of a late Pleistocene marine terrace at Goleta, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 158-159, 1970.

Wszolek, Patricia C. *See* Burlingame, A. L. 07994

08097 **Wyoming Geological Association; Barlow, James A., Jr.** (editor). Symposium on Tertiary rocks of Wyoming — 21st field conference, 1969, guidebook: Casper, Wyo., Petroleum Inf., 232 p., illus., tables, 1969.

This guidebook, dedicated to Donald L. Blackstone, Jr., of whom a brief biography and portrait is presented, includes 31 papers (cited separately) on Tertiary geology in Wyoming. Ten papers are on stratigraphy, 8 on oil and gas, 3 on coal, 3 on uranium, and 6 deal with other minerals and ground water. Road logs for three days of field trips are included and are cited separately also. — HRC

00391 **Yancey, Thomas E.** Provenance and accumulation of sediment on the continental shelf in Monterey Bay, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 159, 1970.

Yeats, Robert S. *See* Tabor, R. W. 00377

00392 **Yeats, Robert S.; Cole, Mark R.; Merschat, Walter R.** Eocene paleogeography of the southern California borderland [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 159-160, 1970.

00393 **Yeats, Robert S.** Stratigraphic evidence for Catalina Schist basement north of Channel Islands, California [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 160, 1970.

00474 **Young, Richard A.** Geomorphological implications of pre-Colorado and Colorado tributary drainage in the western Grand Canyon region: Plateau, v. 42, no. 3, p. 107-117, illus., 1970.

Evidence from partially buried, abandoned stream channels and barbed drainage patterns supports the conclusion that the Colorado River developed after middle Miocene time on the Hualapai Plateau in the western Grand Canyon region. Some Colorado River tributaries in lava flows exhibit sinuous, incised patterns not formed by superposition. — Author's abstract

Yule, H. P. *See* Wainerdi, R. E. 07993

00394 **Zanetti, John; McEvilly, T. V.** Analysis of a microearthquake aftershock sequence [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 160, 1970.

08062 **Zaslavsky, Dan.** Fluctuations in soil environment and their physical significance: Soil Sci., v. 108, no. 5, p. 326-334, 1969.

Most soil processes of faster rate are motivated by periodic changes in the environments. Some have been recognized — rain storms, drying, changes in radiation, and temperature. These fluctuations tend to decay with depth to produce a more or less steady state. — JWH

07810 **Zen, E-an.** Stratigraphy, structure, and metamorphism of the Taconic allochthon and surrounding autochthon in Bashbish Falls and Egremont quadrangles and adjacent areas, Trip 3 *in* Guidebook for field trips in New York, Massachusetts, and Vermont — New England Intercollegiate Geol. Conf., 61st Ann. Mtg., Albany, N. Y., 1969: Albany, N. Y., SUNY-A Bookstore, p. 3-1 — 3-41, illus., 1969.

A field trip of 30 miles with 7 stops starts at Great Barrington and ends in North Hillsdale, and a field trip of 24 miles with 6 stops begins near Hillsdale, Mass. and ends near Salisbury, Conn. Data has been gathered which shows that (1) there is mappable stratigraphy within the Stockbridge Formation in the country surrounding the Taconic Range; (2) an angular unconformity exists between the Stockbridge and the overlying Ordovician Walloomsac Formation; (3) the carbonates have been deformed at least twice with noncoincident fold axes; (4) the pelitic schists of the Everett Formation occur as one or more sheets overlying the Stockbridge and Walloomsac Formations; and (5) the rocks in the Taconic Range have undergone two episodes of regional metamorphism. — HRC

Zharkov, V. N. *See* Magnitsky, V. A. 07875

07876 **Zietz, Isidore.** Aeromagnetic investigations of the Earth's crust in the United States, *in* The Earth's crust and upper mantle: Am. Geophys. Union Geophys. Mon. 13 (Natl. Acad. Sci.-Natl. Research Council Pub. 1708), p. 404-415, illus., 1969.

Magnetic profiles along a 100 mile-wide belt across the continent reveal anomalies with short wavelenghts, reflecting contrasting lithologies in the upper part of the crust, and anomalies with much longer wavelengths, probably reflecting lithologies at great depth. The magnetic data indicate a predominantly silicic mobile upper mantle in the region west of the Rocky Mountains and a predominantly mafic crust and relatively stable upper mantle in the eastern part of the continent. The data agree well with heat-flow data from various areas and with interpretations of the anomalous gravity pattern of the Mid-continent gravity high. — MS

07861 **Zimmerman, R. A.** Stratabound barite deposits in Nevada — Rhythmic layering, diagenetic features, and a comparison with similar deposits of Arkansas: Mineralium Deposita, v. 4, no. 4, p. 402-409, illus., 1969.

The barite deposits in the Shoshone Range contain rhythmic layering of several types. One type includes interlayered barite and clay seams with iron oxide grains and stains, where barite beds gradually change in thickness upwards. Top-bottom (geopetal) features are present but differ from those observed in the Arkansas Stanley Shale deposits. Chert and very fine-grained quartz are interlayered with the barite. The thickest barite beds lie where the chert and shaly layers are thinnest. These are features one would normally find in a sediment. These and other observations suggest a formation by syndiagenetic processes. — Author's abstract

Zoltai, Tibor. *See* Ito, Tei-ichi. 08081

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